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Wisconsin's Forest Resources

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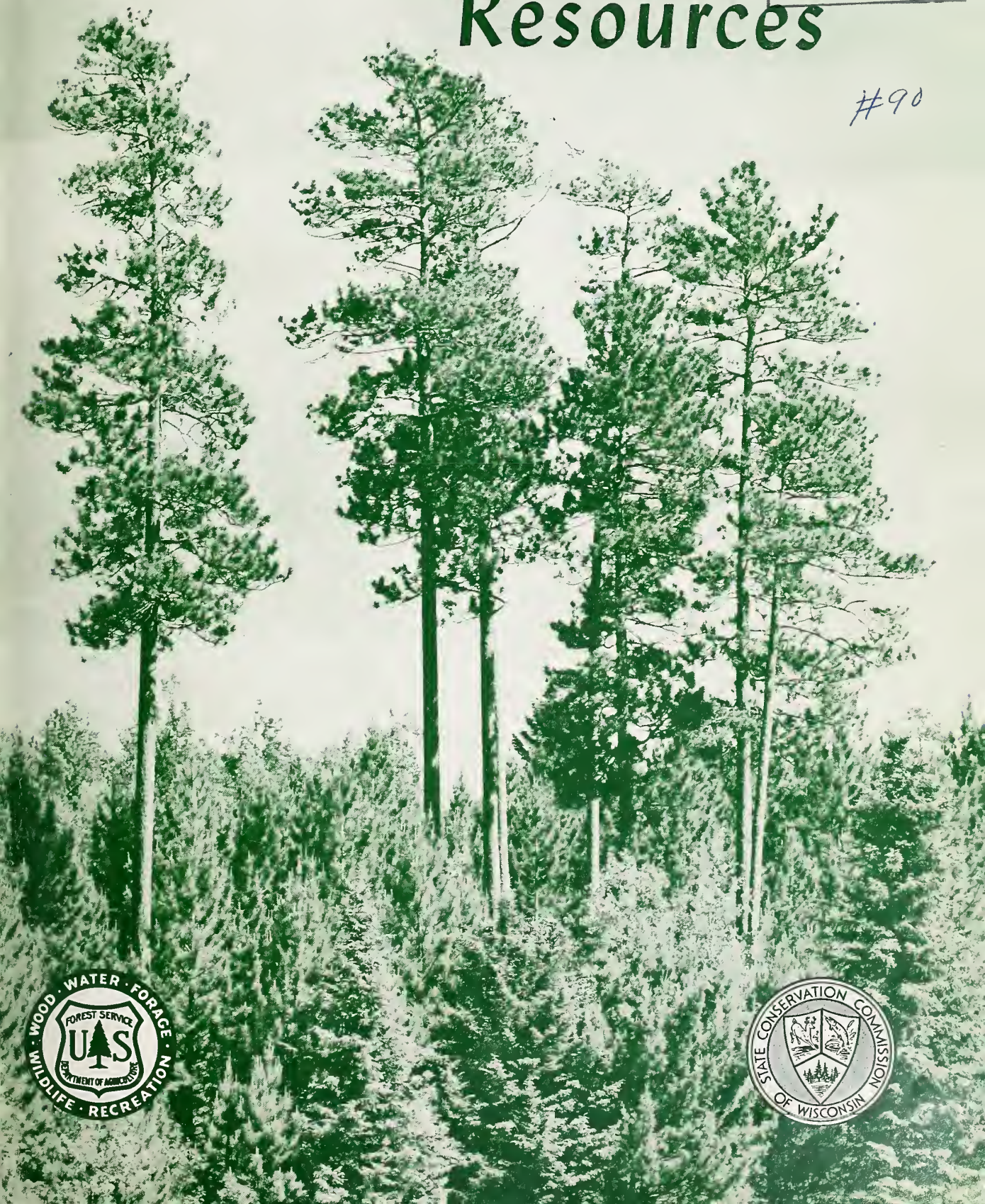

Preface

This report presents the latest forest resource statistics for Wisconsin as determined by the Forest Survey made between 1950 and 1958. This, the second complete forest inventory of Wisconsin, followed by about 20 years the first timber inventory, which was initiated in 1935 and completed in 1937.

These surveys fulfill federal responsibilities under the McSweeney-McNary Forest Research Act of 1928 which authorized the U. S. Department of Agriculture to examine and evaluate periodically the forest resources of the United States. In Wisconsin large-scale State, county, and forest industry participation greatly increased the accuracy of the statistics and provided detailed reports for each county.

Planning of the second survey began in 1949. The Wisconsin Conservation Department organized the financial support and assumed responsibility for surveying public lands under its jurisdiction as well as all private lands, except for several counties in southwestern Wisconsin that were covered by the Lake States Forest Experiment Station. The National Forests and the Bureau of Indian Affairs surveyed the lands under their management. The 32 northern and central counties helped finance the forest inventory within their respective counties. Several other public agencies and private companies provided financial and technical assistance. Fieldwork for the second survey was completed late in June 1958.

Contributions of the Lake States Forest Experiment Station include helping to design the survey procedures and coordinating the effort with other Forest Surveys so that results would be additive to other Lake States and nationwide forest resource figures. The Station also compiled the timber cut and forest industry information, and determined forest land ownership, timber mortality, sawtimber quality, logging residue, and sampling accuracy. The Wisconsin Conservation Department did the fieldwork for the timber cut studies and helped with mortality, quality, and residue studies.

An advisory committee of private and public forestry leaders helped to define the objectives and guide the progress of the work.

Many of the statistics resulting from this survey have previously been presented in 37 county or block reports published by the Wisconsin Conservation Department, and in 6 Technical Notes of the Lake States Station. This, however, is the first presentation of statistics for the entire State and the 5 districts, along with an analysis of the Statewide timber resource situation.

The statistics are presented as of 1956. For the northern counties, the original data were collected in some areas as early as 1952. In southern Wisconsin the data include counties sampled during 1957 and 1958.

All large and medium sawmills, pulpmills, veneer mills, and other forest industries using logs and bolts were canvassed individually in 1956.

Although this report primarily presents timber resource information, it does not imply that wood is the only forest resource. Other values not included in this study, such as water, fish, and wildlife, add immensely to the recreational, social, and scenic bounty of Wisconsin's forest lands.

Space does not permit mention of the many individuals who participated in the planning and execution of the survey and analysis of the data. Special acknowledgement, however, must be made to the following: S. W. Welsh of the Wisconsin Conservation Department, and James T. Morgan and Clarence D. Chase of the Lake States Forest Experiment Station had the general direction of the entire project. Welsh was advised and assisted by D. J. Mackie, C. E. Rieck, E. S. Steigerwaldt, and A. J. Yorman. Arthur G. Horn of the Lake States Forest Experiment Station was responsible for compiling timber cut and product data.

COVER PICTURE—Conifer reproduction under old-growth red pine on the Nicolet National Forest in northeastern Wisconsin. Bordering a bog in the foreground (not shown) are young tamarack, balsam fir, and spruce. Further back on the high land are young red pine.

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Wisconsin's Forest Resources

by

ROBERT N. STONE
Lake States Forest Experiment Station

and

HARRY W. THORNE
Wisconsin Conservation Department

LAKE STATES FOREST EXPERIMENT STATION[1]
M. B. Dickerman, Director
FOREST SERVICE, U. S. DEPARTMENT OF AGRICULTURE

and

WISCONSIN CONSERVATION DEPARTMENT
John A. Beale, Chief State Forester

[1] The Station is located at St. Paul 1, Minnesota, and maintained in cooperation with the University of Minnesota.

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Timber, water, and recreation—three of the uses of Wisconsin's forest land.
(Photo courtesy of Wisconsin Conservation Department.)

HIGHLIGHTS OF THE FOREST SITUATION

A new inventory of Wisconsin's timber resources was completed in June of 1958. During the 20-odd years since the first survey in 1936, the timber situation has improved in a number of important ways. The forests are better stocked, volume is higher, growth is greater, and allowable cut is larger. Competent forestry is being practiced on a larger part of the forest area, particularly on public and industry holdings. Statewide forest fire control has greatly reduced fire losses. Reforested area is accumulating. Considerable improvement has occurred in the overall size-class distribution although serious gaps and deficiencies in important types remain, especially in the conifer types. A great many of the stands that were young seedlings and saplings[1] in 1936 have grown to poletimber and some are approaching sawtimber size. Sawtimber acreage is smaller but should expand as poletimber on large areas grows into sawtimber size.

Other aspects of the forest resources are unfavorable. Softwood acreage remains low. Conifers dominate the stands on less than 14 percent of the forest land of Wisconsin, about the same amount as in 1936. Although pine acreage has climbed somewhat, spruce-fir now occupies less area. The 1.2 million acres of nonstocked and poorly stocked land suitable for planting provides ample opportunity for increasing the supply of softwoods through reforestation.

The problem of excessive cull trees is Statewide. In Wisconsin, for every 11 merchantable trees, a cull tree of merchantable size occupies growing space, reduces net growth of the stands, and adds almost nothing to the timber harvest.

Sawtimber trees were smaller, on the average, in 1956 than in 1936, with somewhat less sugar maple and yellow birch.

The volume of timber lost through mortality each year nearly equals timber cut.

Overall, the total cut is slightly below the allowable cut (the silviculturally desirable cut that can be made while maintaining a steady flow of wood products and improving the balance of tree sizes). In the principal softwood species, however, the acual cut exceeds the allowable cut in every district except southwestern Wisconsin. Overcutting of pulpwood is especially prevalent in central Wisconsin. The cut there not only is greater than allowable cut, but also exceeds the net growth for several key species.

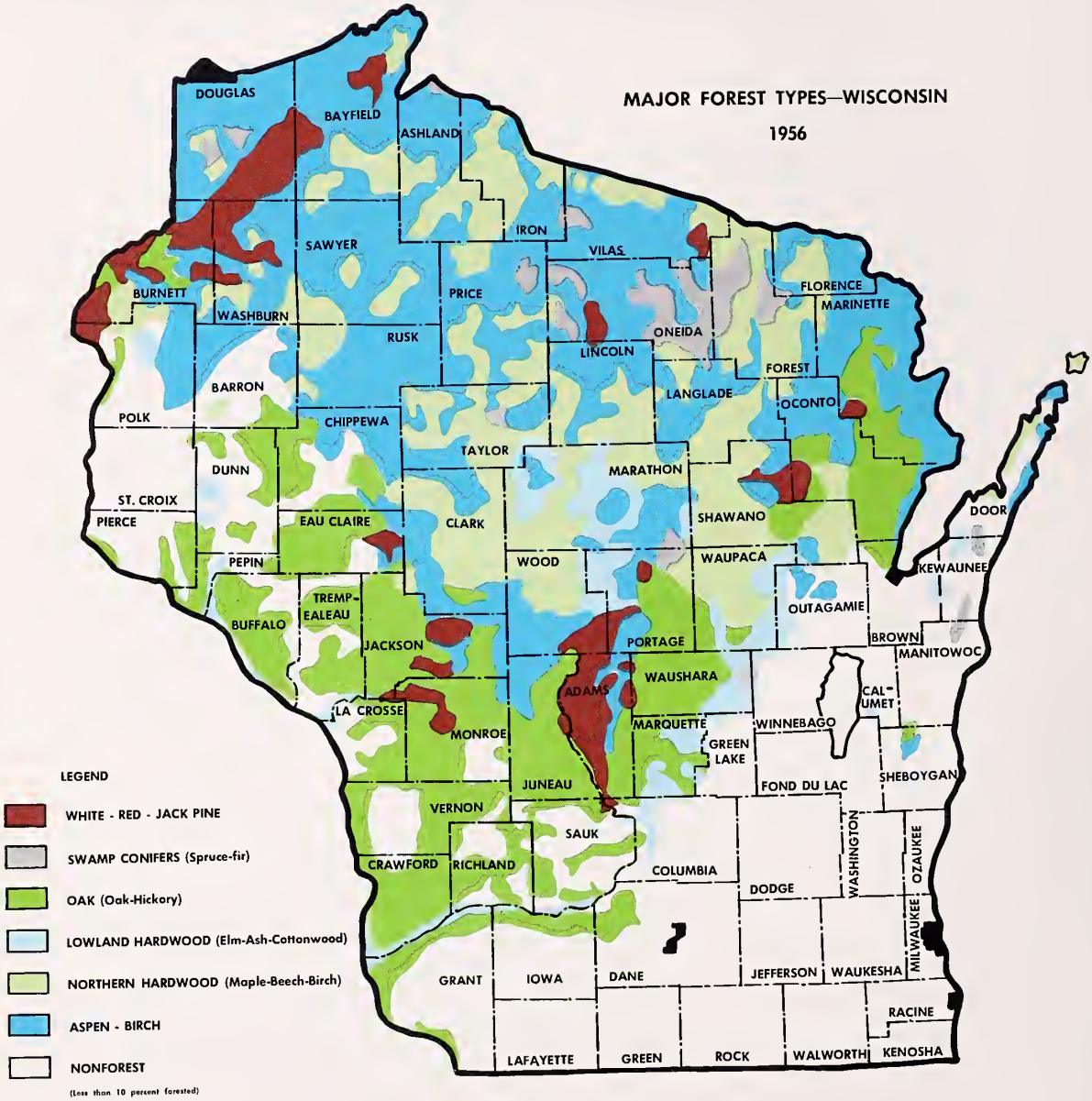
Changes in wood markets since 1936 have strongly influenced the timber resource situation. The major shift in timber cut has been from saw logs to pulpwood. Lumber and veneer industries, although still large, consume less Wisconsin wood than do the pulpmills. Of particular importance has been the phenomenal increase in the use of aspen pulpwood. In 1936, almost all of the pulpwood was softwood. By 1956, 73 percent was hardwood, mainly aspen. Wisconsin timber markets are strong and demand more timber than is harvested in the State. In 1956, about one-third of the wood used by Wisconsin forest industries was imported from other States and Canada.

The findings of this new survey[2] provide new information about the timber resource and trends in wood supplies. Tables presenting complete timber resource findings are given in the Appendix.

Wisconsin's forest lands are important not only for timber supplies but also for water, wildlife, and recreation. The statistics point to some of the problems that stand in the way of achieving full benefits from the forest resource.

[1] For definitions of terms used in this report, see Appendix.

[2] For methods used in conducting the survey, see Appendix.


MAJOR FOREST TYPES—WISCONSIN
1956
DOUGLAS
BAYFIELD
ASHLAND
IRON
VILAS
SAWYER
BURNETT
WASHBURN
PRICE
FLORENCE
MARINETTE
RUSK
ONEIDA
LINCOLN
FOREST
BARRON
LANGLADE
OCONTO
POLK
CHIPPEWA
TAYLOR
DUNN
MARATHON
ST. CROIX
PIERCE
EAU CLAIRE
CLARK
SHAWANO
DOOR
PEPIN
WOOD
WAUPACA
KEWAUNEE
TREMPEALEAU
OUTAGAMIE
BUFFALO
JACKSON
PORTAGE
BROWN
MANITOWOC
WAUSHARA
ADAMS
CALUMET
LA CROSSE
MONROE
MARQUETTE
WINNEBAGO
GREEN LAKE
SHEBOYGAN
JUNEAU
FOND DU LAC
VERNON
SAUK
WASHINGTON
OZAUKEE
CRAWFORD
RICHLAND
COLUMBIA
DODGE
MILWAUKEE
GRANT
IOWA
DANE
JEFFERSON
WAUKESHA
RACINE
LAFAYETTE
GREEN
ROCK
WALWORTH
KENOSHA
LEGEND
WHITE - RED - JACK PINE
SWAMP CONIFERS (Spruce-fir)
OAK (Oak-Hickory)
LOWLAND HARDWOOD (Elm-Ash-Cottonwood)
NORTHERN HARDWOOD (Maple-Beech-Birch)
ASPEN - BIRCH
NONFOREST
(Less than 10 percent forested)

CURRENT TIMBER SUPPLY TRENDS

Forest Area

Wisconsin, even though a great industrial and agricultural State, is 45 percent forested (fig. 1). The land area totals about 35 million acres. Of every 100 acres, 44 are commercial forest land capable of producing crops of industrial wood. In addition to 15.4 million acres of commercial forest, there are about 200,000 acres (1 percent) of noncommercial forest. This land, either in parks, reserves, or inherently unproductive, adds substantially to the wildlife and recreational resources of the State. The term "north woods" aptly describes the distribution of much of the forests —61 percent of the forest land is in the northern portion of the State where most of the timber is presently harvested (fig. 2). Nevertheless, over 6 million acres of commercial forest area are distributed throughout the central and southern parts of the State.

Commercial Forest Area Down 9 Percent

In 1956, the area of land classed as commercial forest was nearly 9 percent less than in 1936. It had declined from 16.9 million acres to about 15.4 million. Acreages of sawtimber, seedling and sapling stands, and nonstocked areas were lower. Poletimber area, on the other hand, increased by over 2 million acres (figs. 3 and 4). The decrease in forest area was caused by a gradual conversion to other uses over the 20-year period. For example, several hundred thousand acres of "stump pasture", formerly considered woodland, were classed as pasture in 1956. In southern Wisconsin alone, more than 700,000 acres of formerly commercial forest are now nonforest. In the southern counties a large share of the pastured woodland has gradually been converted to a more or less open condition, and many of the remaining trees are highly defective.

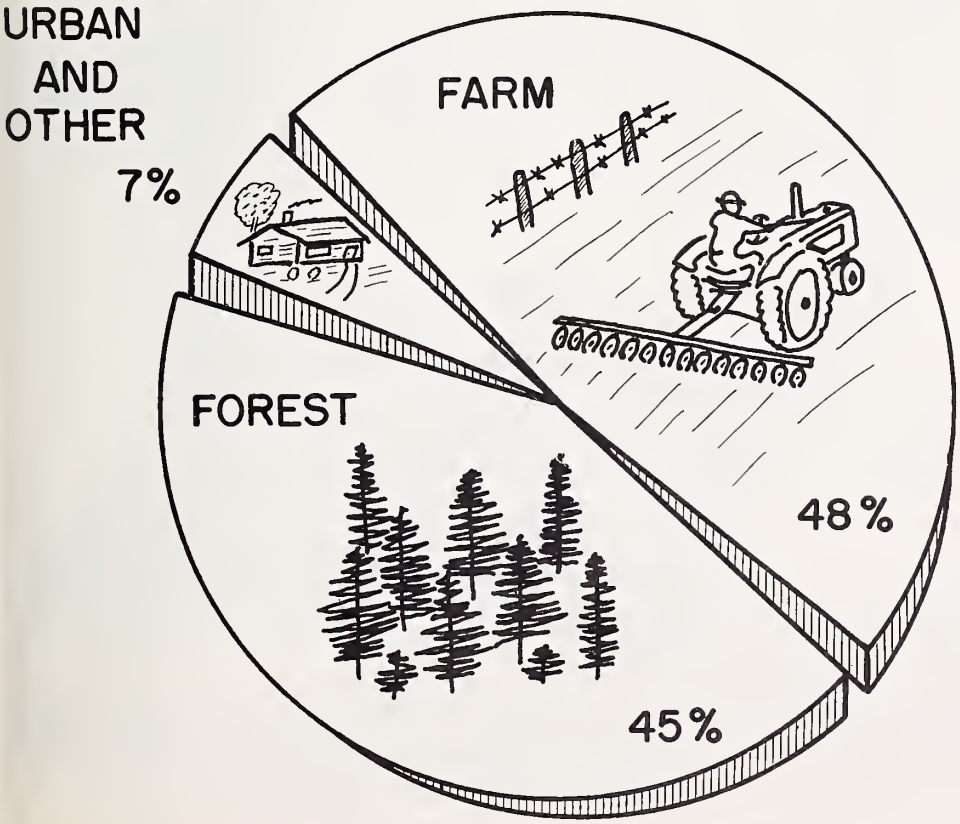


FIGURE 1.—Total land area in Wisconsin by use.

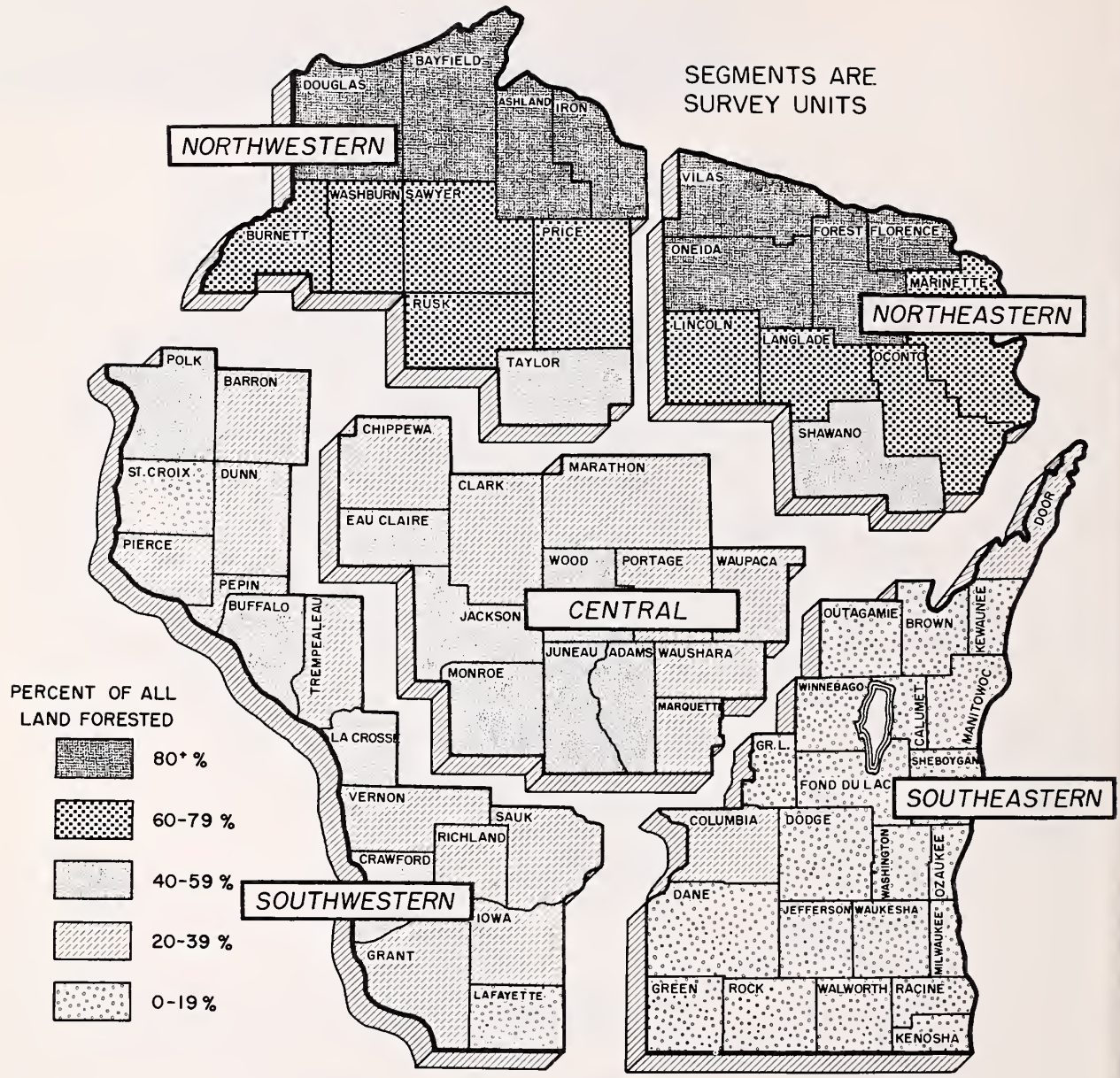


FIGURE 2.—Percent of land forested in each county, 1956.

Forest Ownership Changing Little

Ownership of forest land in Wisconsin is relatively stable. About two-thirds of the commercial forest land is privately owned (fig. 5). The remaining one-third is divided among county, State, and Federal ownership, with county forests comprising the greatest portion. Among all the States in the country only Minnesota has more county forest acreage than Wisconsin. Farmers own 41 percent of the commercial forest land—more than any other group.

Aspen Losing Ground

The trend in aspen-birch acreage is downward (fig. 6). Still, one-eighth of the total land area of the State supports aspen-birch stands (more than 4.6 million

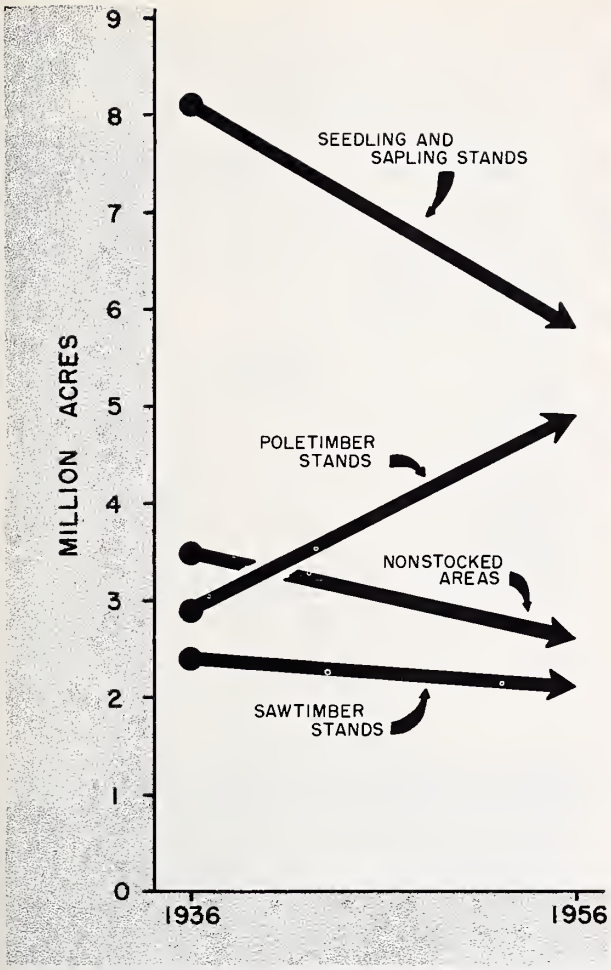


FIGURE 3.—Changes in forest area between 1936 and 1956 by stand-size class.

F-401471

FIGURE 4.—Hardwood poletimber stands are common in the forests of Wisconsin. Hardwood poletimber, representing tomorrow's sawtimber, occupies 4.4 million acres—having more than doubled since 1936.

acres). Aspen, comparatively unimportant in the old-growth forests, rapidly established itself on logged-over land early in this century, particularly where fires followed logging. By 1936, the type dominated 5.6 million acres. Since then its acreage has been declining as more competitive species have invaded the stands, gradually converting them to other types. More recently commercial logging has accomplished the same end; many of the aspen-birch stands in the northern half of the State have conifer understories and logging

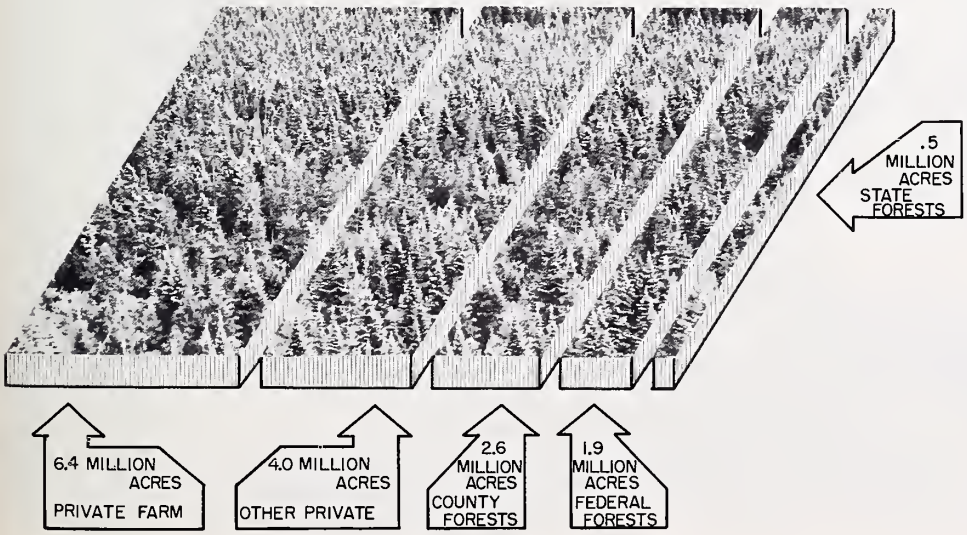


FIGURE 5.—Who owns Wisconsin's forests?

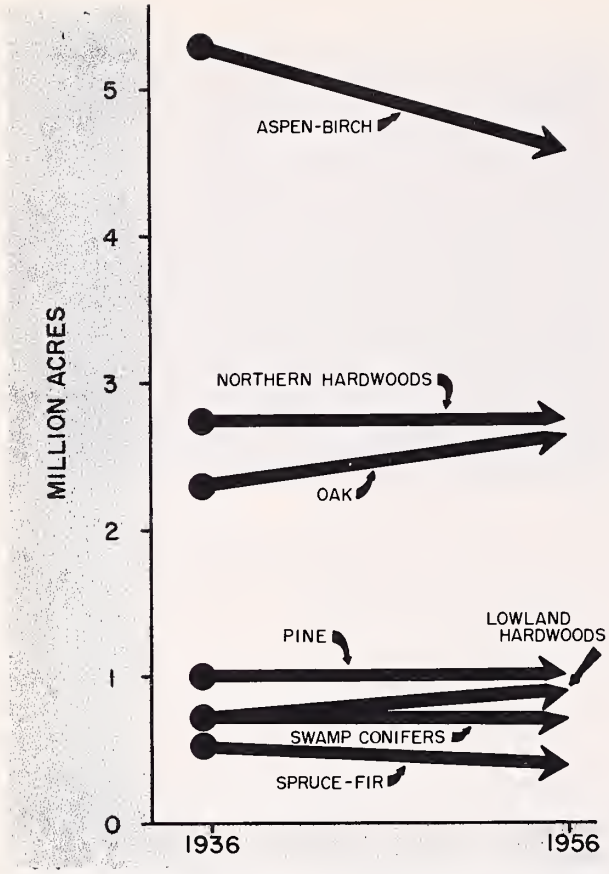


FIGURE 6.—Changes in forest area between 1936 and 1956 by forest type.

releases the young trees (fig. 7). Aspen volume, contrary to the type-acreage trend, has more than doubled during the last two decades as the trees in young stands have reached merchantable sizes.

Aspen-birch is essentially a poletimber type. The typical stand matures at less than sawtimber size (less than 1 percent of the area is sawtimber). During the last 20 years, this type has gained great economic importance, mainly for pulpwood. Since 1936 the acreage of poletimber jumped by 1.2 million acres as the young stands matured.

Like the northern hardwood type, aspen-birch is common in the northern parts of the State (fig. 8). About four-fifths of the type area is in the northeastern and northwestern districts.

About 55 percent of the acreage is privately owned; 45 percent is in public forests.

Northern Hardwood Area Stable

Northern hardwood, second to the aspen-birch type in area, covers 2.6 million acres, about one-sixth of the commercial forest land in Wisconsin. The acreage of northern hardwoods has changed less than any of the major forest types in the last two decades. As the major sawtimber type in Wisconsin, it supports much of the lumber and veneer industries. In 1956, over

FIGURE 7.—Mature aspen overtopping spruce and balsam fir. Here aspen, cut and peeled and ready for the pulpmills, was harvested to remove a mature timber crop and to increase growth on the valuable understory. F-461549

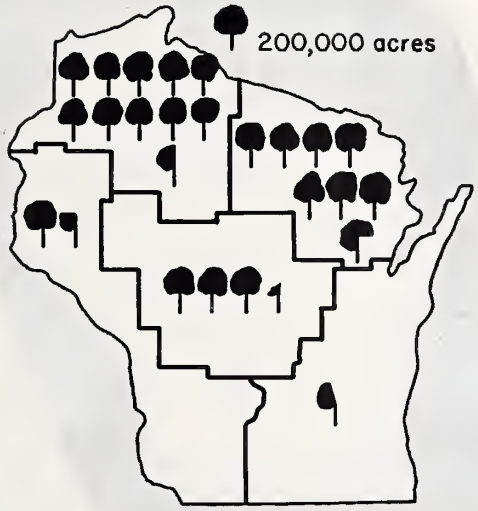


FIGURE 8.—Aspen-birch type acreage, by Forest Survey district.

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FIGURE 9.—Virgin mixed hardwoods on the Nicolet National Forest. The three exceptionally fine trees in the foreground are (left to right) maple, elm, and black ash. This group of trees is a relict of old-growth sawtimber within the stand of poletimber seen in the background.

one-half of the saw logs and veneer logs cut came from hard maple, yellow birch, basswood, and beech, the major northern hardwoods. Prime maple and yellow birch logs invariably bring the highest prices in the State (except for very limited quantities of high-grade walnut and butternut) (fig. 9).

Unfortunately, sawtimber acreage has been declining and now comprises less than one-third of the northern hardwood type. This proportion should be higher since the type develops best in all-aged stands. A gradual increase in the proportion may be expected as pole-timber stands, now covering large acreages, enter sawtimber size.

About 70 percent of the northern hardwood type occurs in the two northern districts (fig. 10). The larger acreage is in the northwestern district although the northeastern district leads in the area of sawtimber. The large lumber and veneer industry in these districts leans heavily on this type for raw material.

Private owners hold two-thirds of the northern hardwood acreage.

Oak Type Increasing

The oak type, rapidly exanding in area, has outstripped its 1936 acreage by 11 percent, or 300,000 acres. It now covers 17 percent of Wisconsin's forest area (2,573,000 acres) compared with 14 percent in 1936.

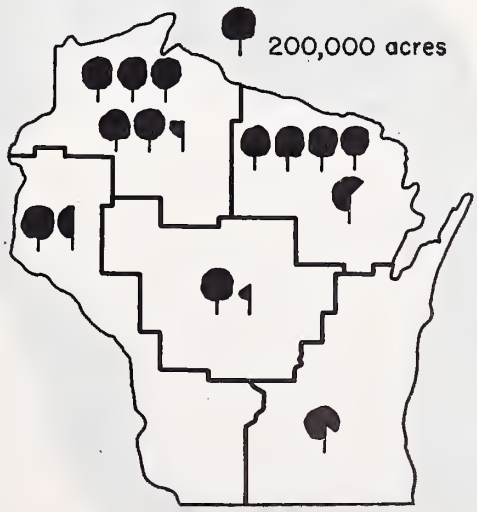


FIGURE 10.—Northern hardwood type acreage, by Forest Survey district.

Oak in Wisconsin usually occurs as a mixture of both white and red oaks in association with maple, basswood, aspen, and other hardwoods. Traditionally, oak has produced saw logs and tie cuts, but in recent years limited amounts have been harvested as pulpwood. Greater use of the smaller oak trees for fiber products is expected. Presently, 33 percent of the acreage is sawtimber, 36 percent poletimber, and 31 percent sapling and seedling stands. Most oak stands are in woodlots across southern and central Wisconsin where a large acreage has been subjected to heavy logging, grazing, and burning for many years (fig. 11). About 89 percent of the oak acreage is privately owned; 72 percent occurs on farms.

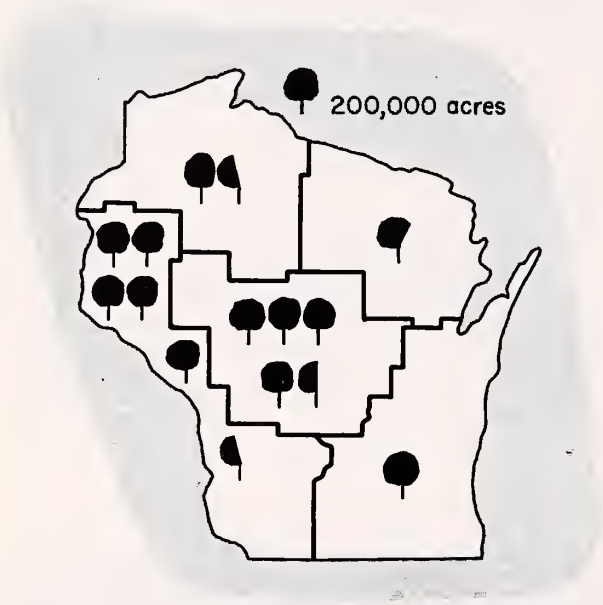


FIGURE 11.—Oak type acreage, by Forest Survey district.

Lowland Hardwoods Gaining

Lowland hardwood, smallest in area of the hardwood types, covers 940,000 acres, an increase of about 270,000 acres since 1936. As the name implies, lowland hardwoods are commonly found along streambanks and in swampy areas. The type includes numerous species and varies in composition across the State. In the north, black ash, red maple, elm, and balsam poplar are common; in the south, silver maple, elm, river birch, and cottonwood predominate.

The chief products are saw logs; yet only about one-fourth of the type acreage is sawtimber.

Lowland hardwoods are found throughout the State although the northern districts have the larger areas (fig. 12).

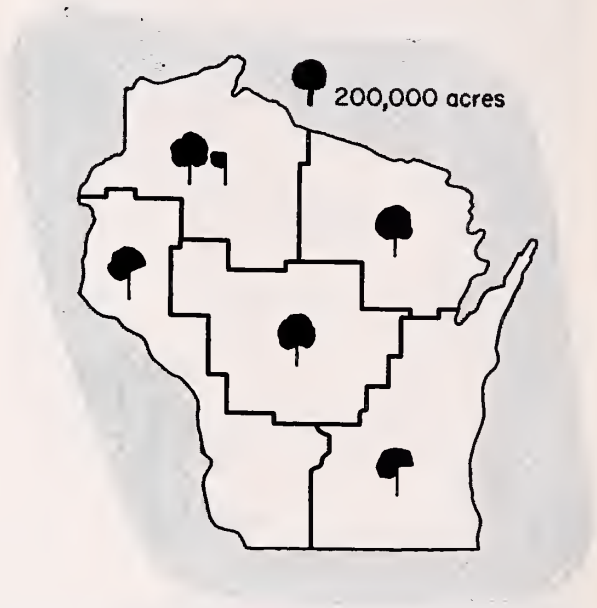


FIGURE 12.—Lowland hardwood type acreage, by Forest Survey district.

Jack Pine Stocking Improves

Wisconsin forests contain 692,000 acres of jack pine, a slight increase over 1936 (665,000 acres). This type tends to be pure and even-aged, although white pine, red pine, aspen, black oak, and jack oak are frequent associates.

Distribution by size-class has also changed little. Poletimber now occupies 27 percent of the type acreage, sawtimber 2 percent, and seedlings and saplings 71 percent. Continued heavy cutting of jack pine, primarily for pulpwood, has maintained the large proportion of immature stands.

Stocking of seedling and sapling stands has greatly improved. In 1956 less than 91,000 acres were poorly stocked compared with 220,000 acres in 1936.

Although the combined acreage of all pine types is highest in the northern districts, the greatest acreage of jack pine is in central Wisconsin (fig. 13).

Private landowners own 57 percent of the jack pine. The 43 percent in public ownership is largely in county and state forests.

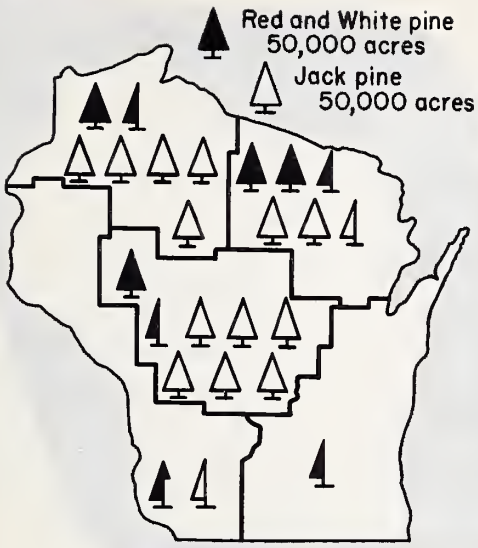


FIGURE 13.—Pine type acreage, by Forest Survey district.

White Pine Area Fading

White pine, second largest of the pine types, covers 174,000 acres. Cutting of scattered old-growth clumps of white pine continues to reduce the type area as evidenced by a 20-percent decline in acreage since 1936.

Two-thirds of the acreage is sawtimber, about one-sixth is poletimber, and one-sixth is in restocking stands. White pine is still far more important in the forests of Wisconsin than its type acreage indicates. The species occurs in many of the conifer and hardwood types and is found in relatively pure stands much less frequently than is commonly realized. About 20 percent of all conifer volume is white pine, yet the white pine type comprises only about 8 percent of the conifer type acreage.

About one-third of the type is in northeastern Wisconsin (fig. 13). Private owners own 64 percent of the white pine area, federal forests include 21 percent, and the county and State forests have 15 percent.

Red Pine Coming Back

Red pine, least extensive of the pine types, covers 148,000 acres. The acreage has been increasing because of widespread reforestation and may soon exceed the area of white pine. The decline in white pine acreage has been more than balanced by the increase of 60,000 acres in red pine since 1936.

Red pine is poorly distributed by size-class; 64 percent is in seedling and sapling stands, 26 percent in sawtimber, and 10 percent in poletimber. Most of the type is found on lighter soils in northern Wisconsin—40 percent in northeastern Wisconsin (fig. 13) where it is often in mixture with jack pine, aspen, white birch, and red maple. Fifty-three percent of the red pine type is in public forests; the remaining 47 percent is about evenly split between farmers and other private owners.

Spruce-Fir Area Still Declining

The spruce-fir type now covers 374,000 acres (fig. 14). It has dropped 41 percent in acreage since 1936—the greatest decrease of any forest type in Wisconsin. Because spruce-fir is one of the most valuable pulpwood types, this downward trend is unfavorable.

Balsam fir is the major species in the type. White spruce and, less frequently, black spruce occur commonly along with pine and white-cedar. Among the associated hardwoods are aspen, paper birch, and red maple.

Balsam fir seldom reaches sawtimber size, maturing primarily as poletimber; white spruce often grows to sawtimber size. Less than 1 percent of the type is in this size compared with 27 percent in poletimber and 72 percent in seedlings and saplings. Spruce-fir acreage is about evenly divided between private and public ownership.

Swamp Conifers Down Slightly

The swamp conifer type-group covers 668,000 acres, 8 percent less than in 1936 (fig. 14). Included in the

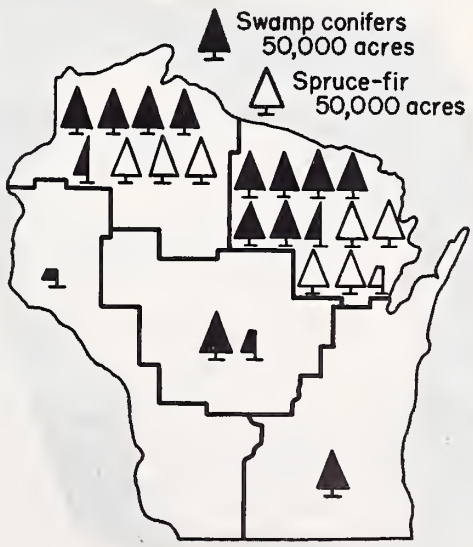


FIGURE 14.—Spruce-fir and swamp conifer type acreages, by Forest Survey district.

broad classification of swamp conifers are stands of black spruce, white-cedar, and tamarack, as well as almost all of the northern conifers and lowland hardwoods.

The main species in the swamp-conifer group, like those in the spruce-fir type, mature primarily as pole-timber and seldom reach sawtimber size. Only 3 percent of the present stands are sawtimber, 27 percent pole-timber, and 70 percent seedling and sapling. Private owners control 58 percent of the area; 42 percent is in public forests. Most of the swamp conifers occur in the northeast and northwest districts.

Grass-Brush Area Large

During the last 20 years, Wisconsin's forests have become better stocked as indicated by thicker stands and a sizable reduction in the area of forest land covered by grass and brush. Nonstocked forest area is 1.1 million acres lower than in 1936, but 2.5 million acres of forest land still remain in grass and brush (fig. 15.)

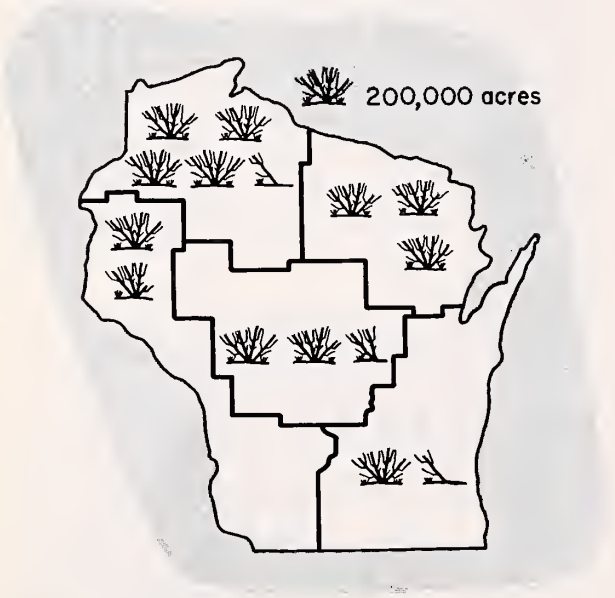


FIGURE 15.—Nonstocked forest acreage, by Forest Survey district.

About 45 percent of the nonstocked forest area is lowland brush, and 55 percent is upland brush and grass. The rising trend in reforestation promises to make further inroads in the nonstocked upland areas. Lowland brush areas, however, present more difficult regeneration problems.

About three-fourths of the nonstocked forest land is privately owned.

Timber Volume

In 1956, Wisconsin's commercial forests contained almost 100 million cords of wood suitable for industrial products, an increasing stockpile of raw material large enough to supply the equivalent of the 1956 timber cut for more than 40 years. This timber volume, called "growing stock", includes 16.3 billion board feet of sawtimber (trees large enough and suitable for lumber) and also good-quality trees of smaller size generally too small to be made into lumber, but usable for pulpwood and other commercial purposes. Growing stock volume increased 12 percent during the 20 years between 1936 and 1956 (fig. 16). In addition to growing stock, there are 22.3 million cords of other material including cull trees, hardwood limbs, and salvable dead trees (fig. 17). Presently this other material has little value except for fuelwood.

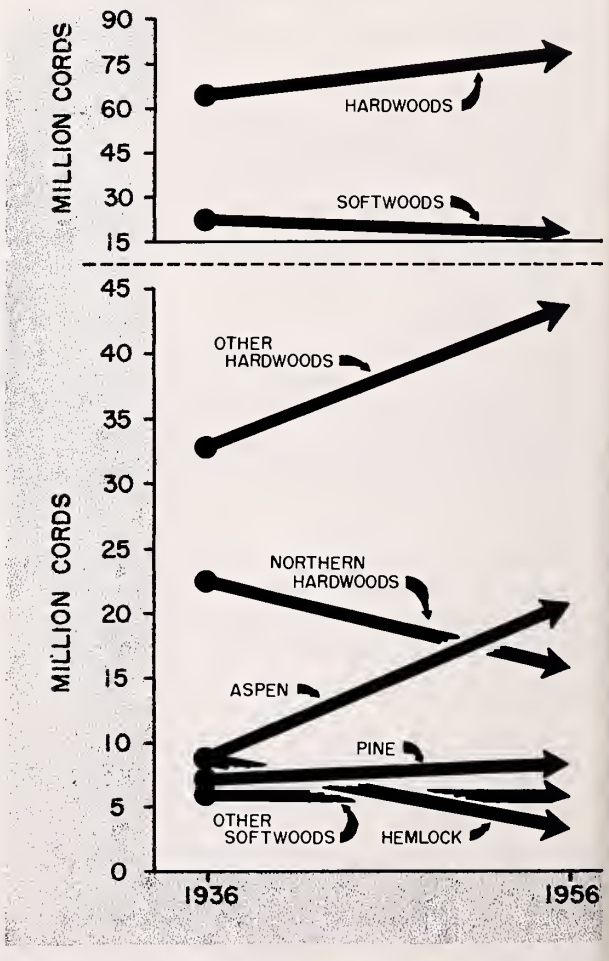


FIGURE 16.—Change in growing stock volume between 1936 and 1956.

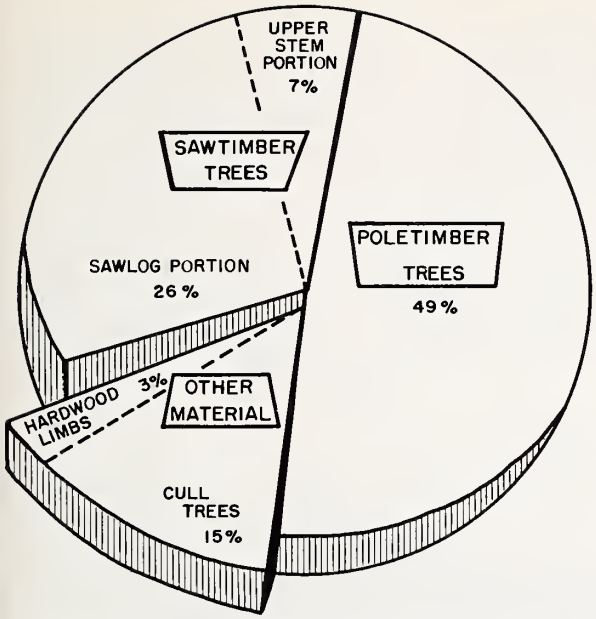


FIGURE 17.—Volume of live timber on commercial forest land by kind of material.

Sawtimber Volume On the Increase

During the 20 years between surveys (1936 to 1956), sawtimber volume in Wisconsin increased by over 1 billion board feet (figs. 18 and 19). Pine, aspen, oak, basswood, and elm now are in greater supply than in 1936, but hemlock, sugar maple, yellow birch, and cedar have decreased. Sawtimber volumes have expanded enough in southern Wisconsin to more than cancel the reduction in northern Wisconsin. However, the overall sawtimber situation presents no substantial improvement over 1936, since timber in southern Wisconsin is found in smaller blocks, has more defect, is of less-preferred species, and is farther from well developed saw log industries.

The potential sawtimber supply shows more promise. Between 1936 and 1956 poletimber acreage nearly doubled. As these stands mature they should add considerable volume to the sawtimber stockpile.

Sawtimber Is Three-Fourths Hardwood

Hardwood trees make up 76 percent of the total sawtimber volume. Red oak, the leading species (appendix table 13), comprises 17 percent of all the sawtimber. Other species with over 1 billion board feet of sawtimber are sugar maple, elm, white pine, hemlock, and white oak. Oak sawtimber volume is increasing faster than that of any other species. Softwoods and northern hardwoods are the major sawtimber species in northern Wisconsin; in southern Wisconsin the oaks are the leading sawtimber species.

Sawtimber Trees Are Smaller, Have Lower Quality

In 1936, about 79 percent of the sawtimber volume occurred in trees 14 inches in diameter and larger; in 1956, only 68 percent was in these larger trees (appendix table 14). Since tree size and saw log quality are closely related, the downward trend in sawtimber tree size has caused a decline in quality. Small logs yield a lower percentage of clear lumber than do large logs.

Not only are the sawtimber trees smaller, but there is less sawtimber volume in some of the preferred species. For example, since 1936 the volume of sugar maple sawtimber has dropped 26 percent and yellow birch 52 percent. The trend is unfavorable even though

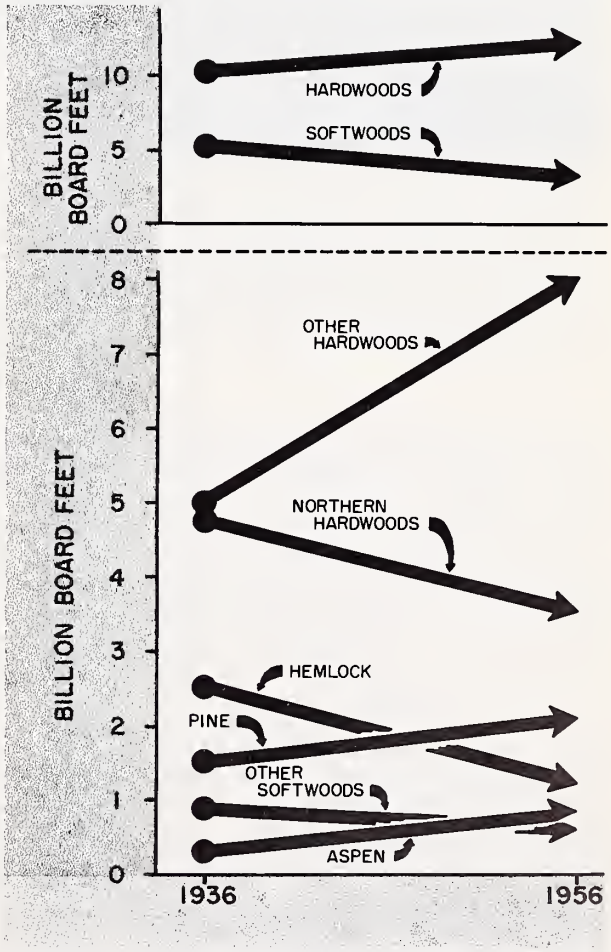


FIGURE 18.—Change in sawtimber volume between 1936 and 1956.

FIGURE 19.—Sawtimber volume of hardwoods has climbed during the past two decades. The present sawtimber area of over 2 million acres produces most of the 400 million board feet of sawtimber trees felled yearly. The overall sawtimber situation shows no substantial improvement, since sawtimber is in smaller blocks, has more defect, and contains more less-preferred species. (Photo courtesy of U. S. Bureau of Indian Affairs.)

the decline has been more than offset by increases in other species, primarily the oaks and aspen. Continued heavy cutting of good-quality sawtimber trees, woodland grazing, and poor logging practices have combined to diminish sawtimber quality. Only 5 percent of the white oak sawtimber volume is in Grade 1 logs (appendix table 20). Sugar maple still has 22 percent of its diminished volume in Grade 1 logs; few species fare better.

Most of the sawtimber trees contain one or more low-quality logs suitable for poor lumber or tie cuts. Poor trees tend to remain in the stand because their wood is seldom worth the cost of cutting and processing.

Aspen Increases Poletimber Volume

Poletimber acreage doubled between 1936 and 1956 with an accompanying increase in pulpwood volume. In 20 years the combined volume of the principal pulpwood species—jack pine, spruce, balsam fir, hemlock, and aspen—increased from 22.9 million cords to 29.8 million cords. The softwoods actually declined in volume from 14.3 million cords to 9.2 million cords, but aspen more than made up the difference, increasing from 8.6 million cords to 20.6 million cords in the same period.

Timber volume in the major pulpwood species is largely concentrated in northern Wisconsin. The northeastern and northwestern districts have about equal volumes of pulpwood; combined, they account for over four-fifths of the State total.

Farmers Largest Owners of Timber Volume

Standing in the farm woodlots of Wisconsin are 41 million cords of timber—42 percent of the total growing stock (appendix table 16). Farmers own 46 percent of the total sawtimber volume of 7.4 billion board feet (appendix table 17). Farmer-owned growing stock and sawtimber are predominantly hardwood. Other private owners comprise the second largest ownership group with 28 million cords of growing stock, including 4.3 billion board feet of sawtimber.

Public forests contain 30 percent of the growing stock volume and 28 percent of the sawtimber volume. The federal forests include 16.3 percent of the growing stock and 18.3 percent of the sawtimber volume. The high per-acre volume on federal lands is largely due to the magnificent stands of old-growth timber concentrated on the Menominee Indian Reservation where volumes average nearly 18 cords per acre. The average per-acre volume on federal forests without the Indian holdings is 6.7 cords.

In 1956, the average volume per forest acre in Wisconsin amounted to 6.4 cords as contrasted to 5.5 cords in 1936. This general improvement in stocking is associated with the reduction in poorly stocked and nonstocked forest acreages.

Over a Billion Merchantable Trees

In 1956, about 1-2/5 billion sound trees over 5 inches d.b.h. were growing on the commercial forest land in Wisconsin (fig. 20). In addition, there are 121 million live cull trees that add almost nothing to the total timber resource but occupy valuable growing space. Over half of the growing stock trees are in the 6-inch size class (5.0-6.9 inches d.b.h), and four-fifths of them are less than 9 inches d.b.h. Aspen is the most numerous species through the 10-inch class. In the larger trees (over 10 inches d.b.h.), there is more red oak than any other species.

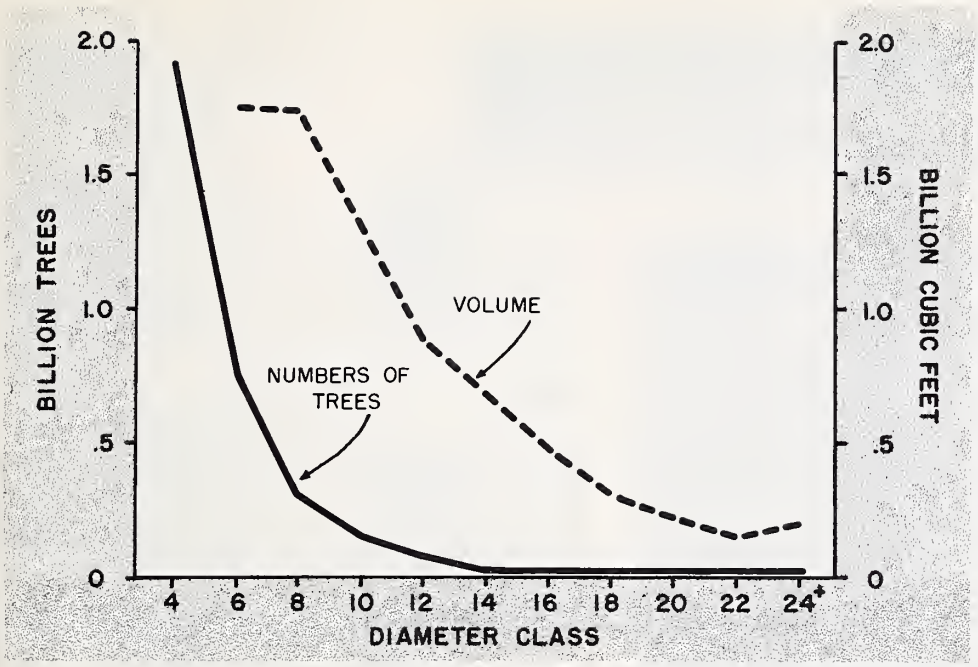


FIGURE 20.—Number of trees and volume by diameter class, 1956.

Some indication of species trends is detected by comparing the numbers of trees found in the large and small size classes. Although aspen has less acreage now than 20 years ago, it has over three times as many merchantable trees as any other species. When only 4-inch trees are considered, it still has nearly three times as many as any other species. Therefore, aspen apparently will be the most numerous species in Wisconsin for several more decades. Declining acreage in the aspen-birch type since 1936 has accompanied the doubling of aspen volume. This trend has not reduced the number of aspen restocking trees. Balsam fir, which ranks 12th in numbers of trees over 5 inches d.b.h, ranks 5th in 4-inch trees. On the other hand, the red oaks, second only to aspen in numbers of merchantable trees, rank 10th in number of 4-inch trees.

Half the Trees Are of Six Species

Over half of the merchantable trees in Wisconsin are aspen, red oak, paper birch, hard maple, white oak, and soft maple. No conifer is found among the six most numerous species, although white-cedar ranks ninth. Overall, trees of the 4-inch diameter class are nearly one and one-half times as numerous as all trees over 5 inches. Species with fewer 4-inch trees than trees over 5 inches (thereby indicating a deficit of young trees), include white pine, red pine, hemlock, yellow birch, basswood, elm, beech, red oak, white oak, and black walnut. These species have only 14 percent of the 4-inch trees in Wisconsin, although they include 29 percent of the trees larger than 5 inches. Many of the most valuable and desirable species found in the forests of Wisconsin are involved. A deficit in the smaller sizes in these species suggests the need for greater research and effort to obtain a higher proportion of them in the reproduction.

Growth

Wisconsin's forests are growing rapidly. Net annual growth for 1956-1966 is estimated at 3.7 million cords (appendix table 24), a daily increase averaging 10,300 cords. The net annual growth equals 3.8 percent of total 1956 volume. Sawtimber is growing faster than all growing stock. In 1956 sawtimber growth totaled 778 million board feet, 4.8 percent of sawtimber volume. Total increment before deducting annual mortality was 5.9 million cords annually.

Although total growth seems favorable, the annual net growth averages only about one-fourth cord per acre of commercial forest land and 100 board feet per acre for sawtimber trees in sawtimber stands. When these averages are compared to growth on well-managed stands growing more than 1 cord or 200 board feet per acre yearly, it becomes clear that timber growth several times the current growth is possible.

The upward growth trend is due in part to improved timber stocking. Net annual growth in 1956 was 16 percent higher than in 1936 (fig. 21).

For sawtimber, the improvement was even more—sawtimber growth increased 59 percent during the 20-year period. Softwood sawtimber growth has climbed by 12 percent since 1936; it has increased in every species but hemlock and red pine. The largest increase has occurred in jack pine and balsam fir, although very little of these species are utilized for saw logs.

Among the hardwoods, only yellow birch had lower sawtimber growth in 1956 than in 1936. Total hardwood sawtimber growth climbed nearly 72 percent, with the greatest increases in aspen, basswood, red maple, and paper birch. Aspen sawtimber growth increased nearly fivefold since 1936; basswood sawtimber growth jumped by two and one-half times.

The 16-percent increase in annual growth of growing stock was largely accounted for by jack pine, spruce, balsam fir, basswood, elm, and red maple. Yellow birch and hemlock had lower growing stock growth in 1956 than in 1936.

Net annual growth rate for the softwoods averaged 3.5 percent of growing stock volumes and 3.8 percent of sawtimber volumes. For hardwoods the growth rate was 3.9 percent for growing stock and 5.1 percent for sawtimber.

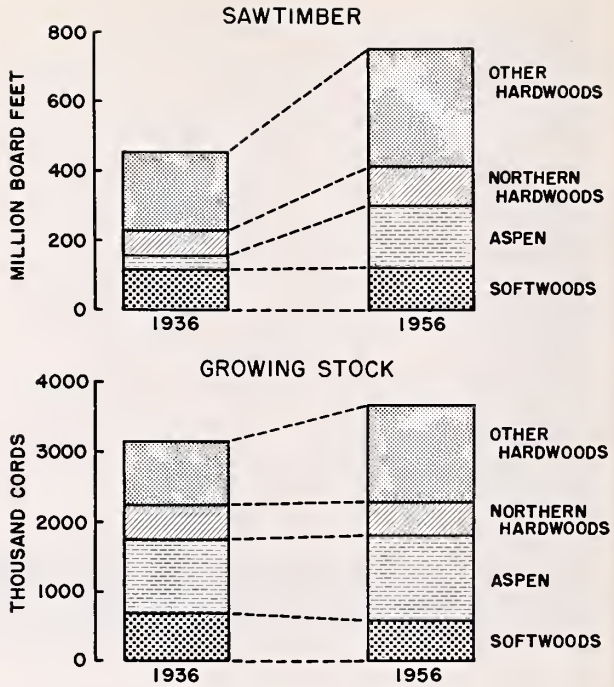


FIGURE 21.—Annual net growth of sawtimber and growing stock, 1936 and 1956.

INCREASING THE TIMBER SUPPLY

Since the 1936 survey a good deal of forestry progress has been made in Wisconsin. In addition to steady progress on public lands, active private organizations such as Trees For Tomorrow are promoting better forestry practices. State and industrial foresters are advising greater numbers of landowners on forest management. Many advances have been made in solving fire, insect, and disease problems on both public and private forests. Reforestation achievements have accumulated, and planting rates climb each year. However, a great deal remains to be done if we are to meet the expected increase in timber demand that will accompany our expanding economy and increasing population.

Big Planting Job Remains

Reforestation can increase the acreage of productive forest land, but the planting job is a big one. In 1959, Wisconsin ranked seventh nationwide in total acreage planted through that year. Of the more than 820,000 acres planted, 43 percent were on private land, 29 percent on Federal forests, and 27 percent on State and county forests. Forest plantings have been mostly pine, chiefly red pine.

Although the majority of the plantations are below commercial size, thinnings from the older ones promise to augment the limited supply of softwood pulpwood (fig. 22).

The area already planted represents an impressive achievement, but the remaining forest land classed as favorable for planting is still large. Out of 6.7 million acres of poorly stocked and nonstocked forest, 2 million acres are restocking naturally, 3.5 million acres were classed as unfavorable for planting because of brush cover, swampy condition, or grazing. Remaining are 1.2 million acres that are favorable for planting. This land has the productive capacity, if reforested, to yield at least a half a million cords of softwoods yearly.

Destructive Agents Reduce Timber Supplies

Insects, disease, fire, wind, and other destructive agents annually kill 2.2 million cords (176 million cubic feet) of timber in Wisconsin (appendix tables 22 and 23). This seems staggering when compared to the 1956 timber cut of 2.3 million cords. If it were economically possible, salvaging the trees that die each year would double the timber cut without cutting an additional live tree. But salvage is considered impractical on most ownerships because the dying trees are scattered throughout the forest and are generally of poor quality. The destructive agents, in addition to killing trees, cause growth losses (fig. 23). These growth losses are due to reduced tree vigor, increased cull, site deterioration, defoliation, and other factors. They also result from delays or deficiencies in stocking caused by destructive agents, and losses in future yields due to killing of trees below merchantable size (5 inches d.b.h.). Although no measurements of growth losses are attempted in Wisconsin, estimates indicate they may be about three times the volume of trees that actually die.

FIGURE 22.—More than 800 thousand acres have been planted to trees in Wisconsin. Thinnings from the older plantings are beginning to add to the supply of merchantable softwoods. (Photo courtesy of Nekoosa-Edwards Paper Company.)

◀ A young red pine plantation in north-central Wisconsin. (Photo courtesy of Wisconsin Conservation Department.)

F-488842

FIGURE 23.—Maple blight-killed tree. The volume of timber that is killed each year by diseases, insects, fire, and other destructive agents nearly equals the total timber cut.

Wisconsin has had no spectacular timber losses from insects or diseases during the last two decades. Nevertheless, these pests annually kill 60,000 cords of softwoods and 700,000 cords of hardwoods. Of the two, diseases are the more damaging, being responsible for 670,000 cords of dead trees each year. A recently implemented pest control law should help in reducing these sizable losses.

Losses From Decay High

In Wisconsin, almost 11,400,000 cords of live timber were classed as rotten cull (trees having over 60 percent of their gross volume unusable because of decay). Most of the decay in these trees resulted from infections of heart rots, such as *Fomes igniarius, F. p'ni, and Polyporus schweinitzii* (fig. 24).

Rotten cull trees have almost no commercial value, but they occupy valuable growing space that might be used better by healthy trees. Since they are seldom harvested they also tend to accumulate, being by-passed during each successive logging operation.

Losses from decay are not confined to cull trees. For example, average defect for merchantable sawtimber trees varied from 12 percent for ash to 17 percent for black oak. Much of this defect is caused by heart rots.

Fire Losses Low

Fire, the traditional enemy of forest managers, now rarely causes major timber damage, although the threat remains (fig. 25). Fire control has advanced a long way since the days of the great Peshtigo fire in 1871. That fire, one of the worst catastrophes in American history, killed more than 1,500 persons and burned over 1,280,000 acres. During the early 1930's, fires averaged about 3,000 per year, and 286,000 forest acres were burned over annually. For 1951-57, the number of fires each year averaged just over 1,000 and damaged about 3,400 acres.

All of Wisconsin is now protected with well-organized forest fire-fighting organizations equipped with modern suppression tools.

Reversing the long-term trend, the annual number of forest fires has been slowly increasing the last few years as more and more people use the woods. With the majority of the hardwood stands thickening up and becoming less susceptible to serious fires, the fire hazard in the hardwood portion of the forest land still shows a declining trend. However, open areas are rapidly being reforested to conifers; here the threat of catastrophic fires remains high. The 17,000-acre Burnett County fire of 1959 points up the mounting fire problems in conifer stands.

F-497044

FIGURE 24.—Defects caused by decay and rots, and by damage from insects, fire, animals, and storms cause a great many trees to be culled. For every 11 sound merchantable-sized trees there is one cull tree.

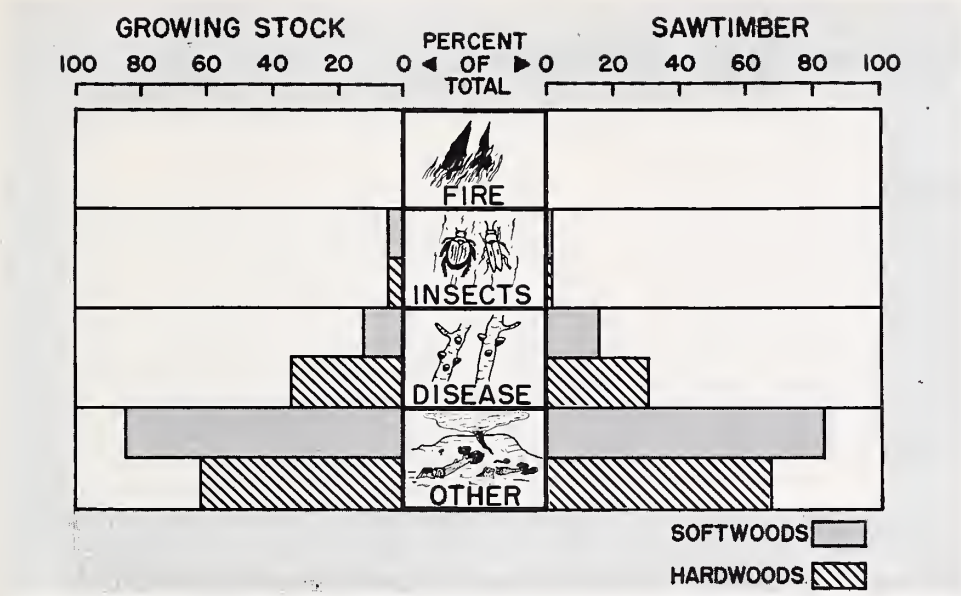


FIGURE 25.—Causes of mortality in Wisconsin timber, 1956. Among "other" causes of death are windstorm, suppression, and animals. Neither fire nor insects kill many sawtimber trees; but insects cause considerable loss in growth.

Woodland Grazing in Southern Counties

Grazing of woodlands is common, especially in southern Wisconsin. In 1956 in the two southern districts, about 1½ million acres of woodland were so heavily grazed that natural tree reproduction was impossible and planting could not be recommended. Pasturing of cattle in woodlands has been detrimental to the quality, productivity, and species composition of many farm woodlands. In southern Wisconsin, 46 percent of the woodland is heavily grazed; in addition, another 17 percent is grazed to some extent. Woodland grazing utilizes relatively small amounts of forage but seriously reduces production of quality logs. Pasturing and timber production are not compatible on Wisconsin woodlands (fig. 26).

Some Losses Occur in Logging and Milling

Part of the timber cut each year from growing stock is left unused in the woods. About 9 percent of the cut is left following logging, although there is generally close utilization of the better grades of timber. Most of the logging residue consists of rough material from the upper part of the tree stem, and logs and bolts broken in felling or lost enroute from stump to mill. Another 8 percent becomes plant residue, mainly sawmill slabs and edgings. Most of the plant residue has little practical use other than for fuelwood. With present technology and equipment, the cost of salvaging generally exceeds its value. Furthermore, nine-tenths of the logging residue is hardwood where surplus volume also is found in low-quality standing trees.

F-439588

FIGURE 26.—Farm woodlands, when protected from destructive grazing and fire, are often highly productive wood factories. This woodlot containing black cherry and red oak has only recently been protected from heavy grazing.

Greater use of slabs and edgings for pulpwood may

be in the offing, particularly at the larger plants that use some softwood timber. At small, scattered mills formidable problems in transporting and debarking the residues make it difficult for this material to compete with conventional pulpwood.

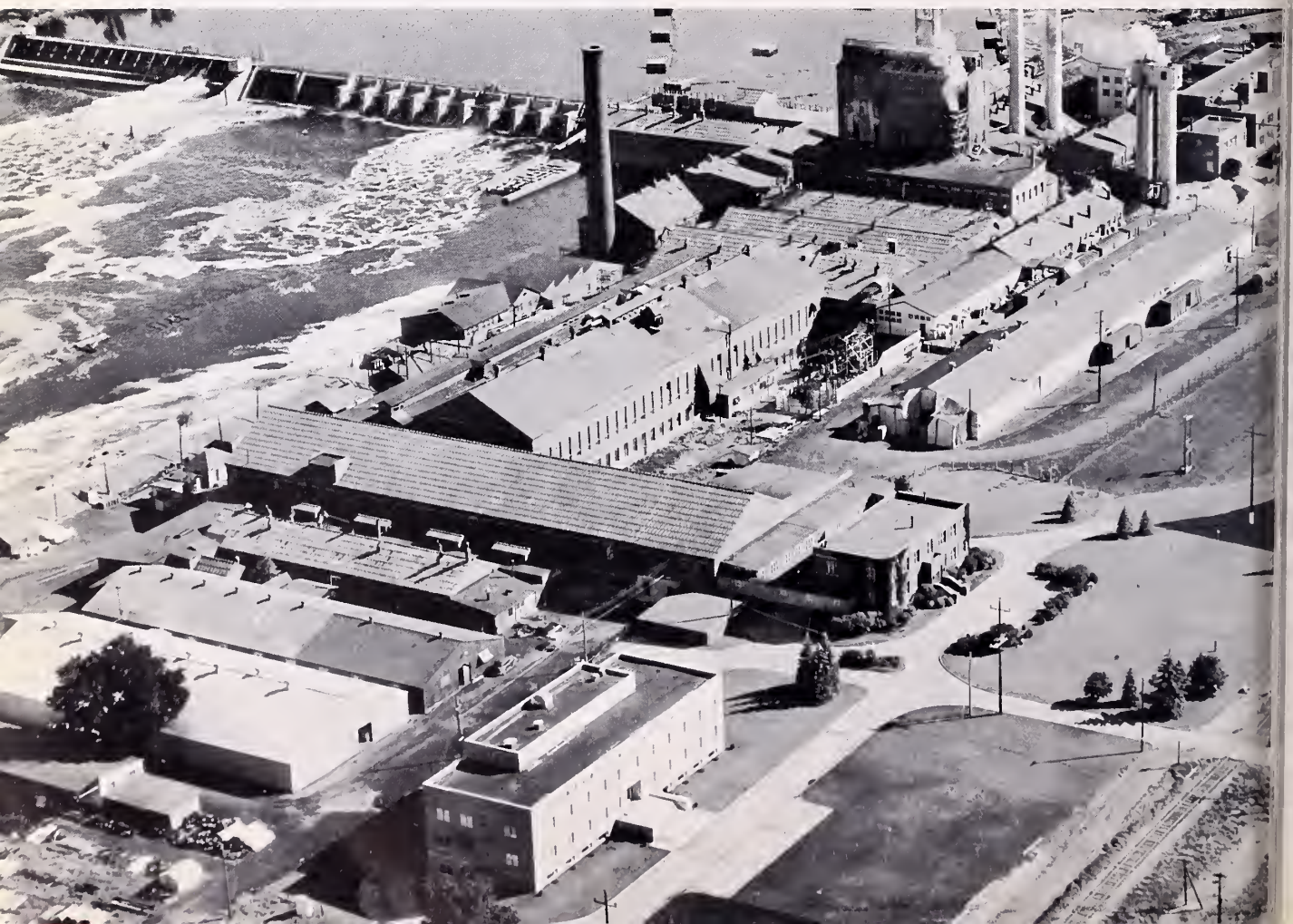
Improvements that reduce the amount of woods and mill residues are bound to come and may soon be important locally. However, if only half of the plant residues could be chipped and used, a volume equivalent to 100,000 cords annually would be salvaged. This would have the same influence on present timber supplies as increasing net growth by about 3 percent. Future supplies though, depend on proper cutting of present stands to establish more productive stands. In this regard, improved cutting practices may be better "conservation" than using plant residues.

Small Owner Key to Future Wood Supplies

The least productive forest conditions and the most difficult problems of marketing are found on the holdings of farmers and "small private" owners (those with less than 5,000 acres of forest land each), many of whom hold their lands primarily for purposes other than timber growing. In the aggregate, farm and small private ownerships include 60 percent of Wisconsin's commercial forests, and for many years they have supplied a large proportion of the raw material used by forest industries. Since these ownerships total more than 9 million acres they are a key factor if wood supplies are to be increased.

In Wisconsin, small private and farm owners number over 143,000 persons, each small private owner having an average of 120 acres of woodland and each farmer an average of 45 acres.

Wisconsin assists the small owner in meeting technical problems of forest management by making available the services of 65 Farm Foresters. Furthermore, the Agricultural Conservation Program and Soil Bank offer incentives to the small owner to improve his woodland or plant trees on his unneeded cropland. Yet the small owners, as a group, are not practicing forestry. Grazing and indiscriminate logging are common and, as a result, income from rundown woodlots is small and infrequent. In many cases, the owner sees little incentive to spend time and money in an effort to raise woodlot productivity. Nevertheless, future timber supplies for Wisconsin's timber industries rest largely upon the actions these owners take in regard to improving their timber stands.



Where the Wood Goes

Wisconsin's wood-using firms comprise an important part of the State's industry. In 1954, almost 60,000 persons were employed in forest industries—1 out of every 7 employees of manufacturing firms. They earned salaries and wages of $237,000,000 annually, and made products worth about $460,000,000. About 1,750 primary wood-using plants (users of logs and bolts) operated in Wisconsin during 1956 (appendix table 30). More than 1,600 were sawmills, pulpmills numbered 29 and veneer plants 47, and there were 49 others. About 8,000 cords of wood are used daily by these wood-processing plants. The woodpulp plants have the largest capital investment, employ the most people, and require the most wood.

The production of timber products in Wisconsin has declined slightly since 1936. Fewer saw logs, veneer logs, and fence posts and less fuelwood were produced in 1956 than in 1936 (fig. 27). Largely offsetting this trend has been the rapid increase in pulpwood output.

Woodpulp Plants Expand Production

In 1956 Wisconsin had 29 separate woodpulp plants. Many of these had 2 or 3 pulpmills at the same location, often under the same roof. An example of this is a plant located in Wisconsin Rapids which includes a sulphite pulpmill, a groundwood mill, and a semi-chemical pulpmill.

In the last nationwide Census of Manufactures (1958), Wisconsin ranked first in production of paper and board products; the 29 mills produced 2,062,000 tons. In 1956 the State ranked sixth in woodpulp plant capacity—3,900 tons daily. By 1959 Wisconsin's pulpmills had expanded capacity to 4,155 tons daily as the industry continued to grow. The pulp and paper industry in Wisconsin produces almost every kind of paper products from writing bond to paperboard. Two-thirds of the pulpmills in Wisconsin are located along the Fox and Wisconsin rivers.

◀ The Marathon Paper Mill on the Wisconsin River at Rothschild. (Photo courtesy of Marathon, a Division of American Can Company.)

The pulp and paper industry is the largest importer of wood to Wisconsin; it buys not only from neighboring Michigan and Minnesota but also from Colorado, Montana, South Dakota, and Canada (fig. 28). Wisconsin wood users, in 1956, imported 1.3 million cords of logs and bolts to augment the 1.9 million cords produced in the State (fig. 29). The pulp and paper industry alone used 1.2 million cords of wood from out of State.

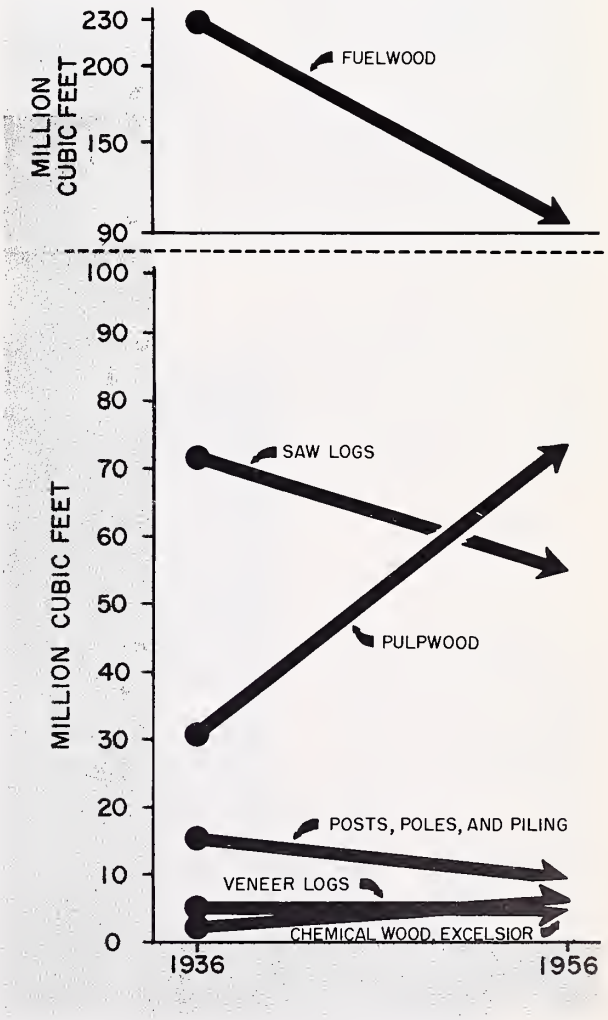


FIGURE 27.—Trends in output of major timber products, 1936 and 1956.

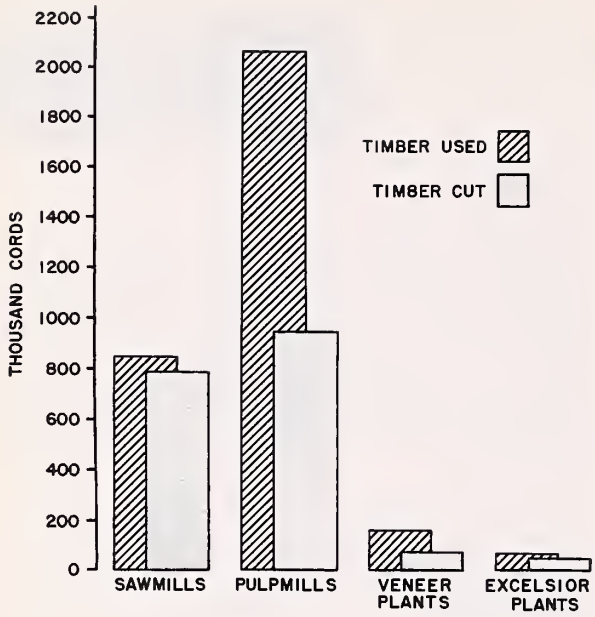


FIGURE 28.—Wood used by major forest industries and the amount cut from Wisconsin forests show that wood imports by Wisconsin forest industries are substantial.

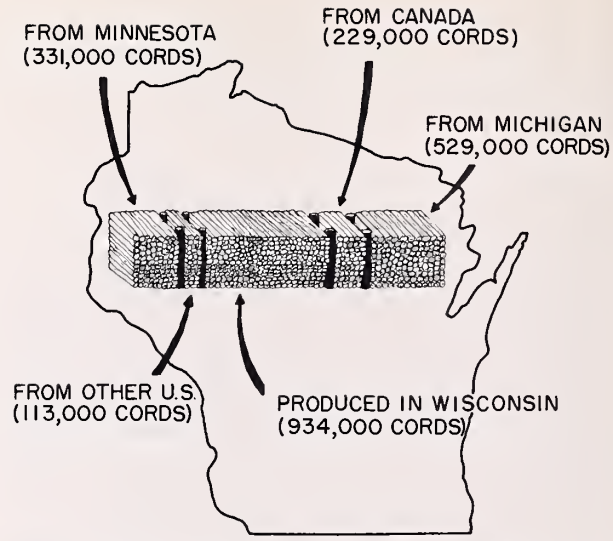


FIGURE 29.—Source of pulpwood used in Wisconsin, 1956.

Pulpwood Production Up

Wisconsin's pulpwood harvest has been increasing over the years because of expanding use of aspen (figs. 27 & 30). The cut of hardwoods, including aspen, for pulpwood has increased from 32,000 cords in 1936 to 692,000 cords in 1956. During the same period softwood pulpwood production has declined 50 percent. Northeastern, northwestern, and central Wisconsin produced all but 1 percent of the 1956 pulpwood cut (fig. 31).

The 1956 cut of pulpwood totaled 960 thousand cords and included more wood than did the cut for any other commercial product (fig. 32). (Fuelwood, cut mainly for home use, exceeded both pulpwood and saw log use in total volume.)

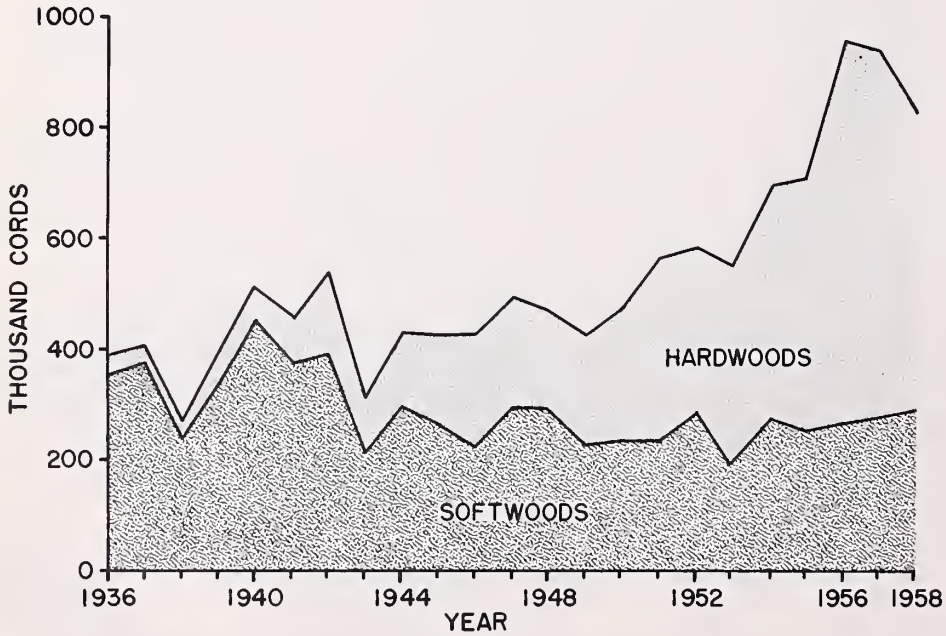


FIGURE 30.—Trend in pulpwood production, 1936 to 1958.

Sawmills More Numerous But Smaller

Although the production of lumber has declined since 1936, sawmills are more numerous than they have ever been. In 1956 there were 1,628 compared to 1,538 in 1936. Only 63 of these mills saw more than 1 million board feet of lumber annually; but they produce about half of the lumber. Most of the mills sawing over 5 million board feet a year are in northeastern Wisconsin. During the last 20 years, several of the largest sawmills have gone out of business as the concentrations of old-growth timber were cutover. The single remaining mill sawing over 20 million board feet of lumber annually is the Menominee Indian Mill (fig. 33). This plant is supplied by timber from the Menominee Reservation, which contains the largest block of northern hardwood sawtimber in the State. Sawtimber stands on the Reservation contain 13.5 percent of the total saw log volume found in the sawtimber stands of the entire State.

Typical of the medium-size mills is the one at Tigerton. It employs 115 persons and produces over 30,000 board feet of hardwood lumber each working day. A new chipper at the mill converts slabs and edgings into chips that are used by chemical plants.

About one-third of the sawmills sawed for factory

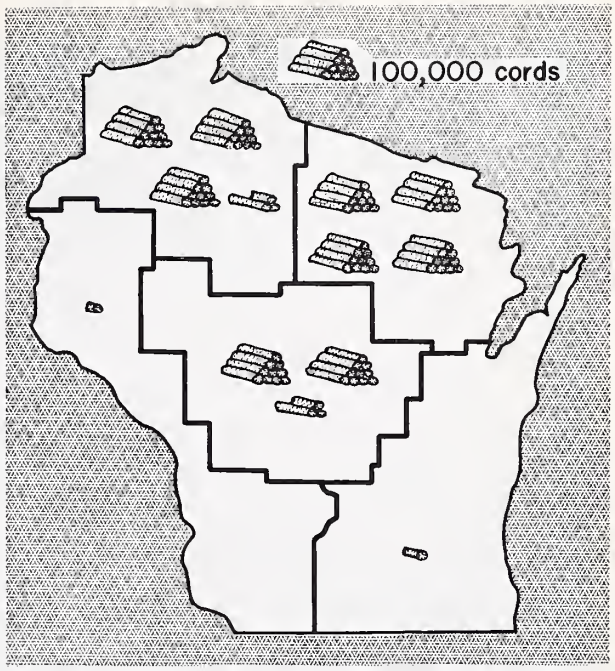


FIGURE 31.—Where pulpwood was cut in 1956. Aspen and other hardwoods made up 72 percent of the pulpwood harvest.

FIGURE 32.—Pulpwood production has more than doubled in the last 20 years. More wood is cut for pulpwood now than for any other commercial product. (Photo courtesy of Nekoosa - Edwards Paper Company.)

FIGURE 33.—The Menominee Indian Mills, largest operating sawmill in Wisconsin, is owned by the Menominee Indian tribe. This plant produces lumber in excess of 20 million board feet yearly. The physical plant consists of a double-band saw with two electric headrigs, a horizontal resaw, and related facilities. The plant employs about 140 men; another 150 men are employed in woods operations. (Photo courtesy of Bureau of Indian Affairs.)

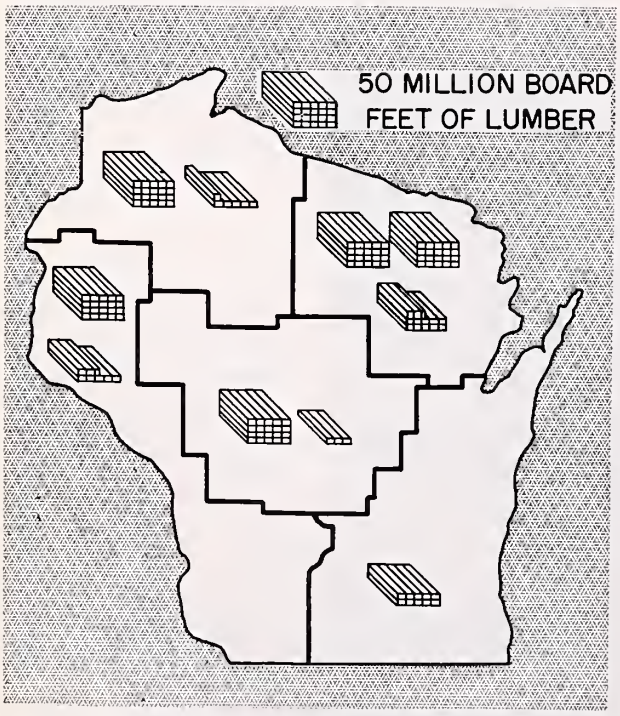


FIGURE 34.—Where lumber was produced in 1956. Nearly all the lumber sawn in southern Wisconsin was hardwood. In the northern districts one-fourth of the lumber was produced from softwoods.

or commercial use; one-fourth sawed primarily for the owner's use; and 4 out of 10 worked on a custom basis, sawing logs for others, generally neighbors.

Most of the State's lumber is sawn by mills in northern Wisconsin. Lumber production in 1956 was highest in northeastern Wisconsin, followed in order by northwestern and southwestern Wisconsin (fig. 34).

Lumber Production Leveling Off

Lumber production in Wisconsin climbed swiftly following the Civil War and reached a peak about 1899. As the old-growth timber was cut over a rapid decline followed, with the lowest point reached in 1932. In the last decade lumber production has been around 350,000,000 board feet annually (fig. 35).

The production by species groups shows varying trends. Softwood production, once the backbone of the lumbering industry, has declined from about 209 million board feet in 1936 to 78 million board feet in 1956. A slight increase in the sawing of hardwoods helped sustain the total lumber production. Even though hardwoods have partly replaced softwoods in lumber output, the two are not interchangeable in use. The decline in softwood lumber output has resulted in increased imports of softwood lumber from Southern and Western States.

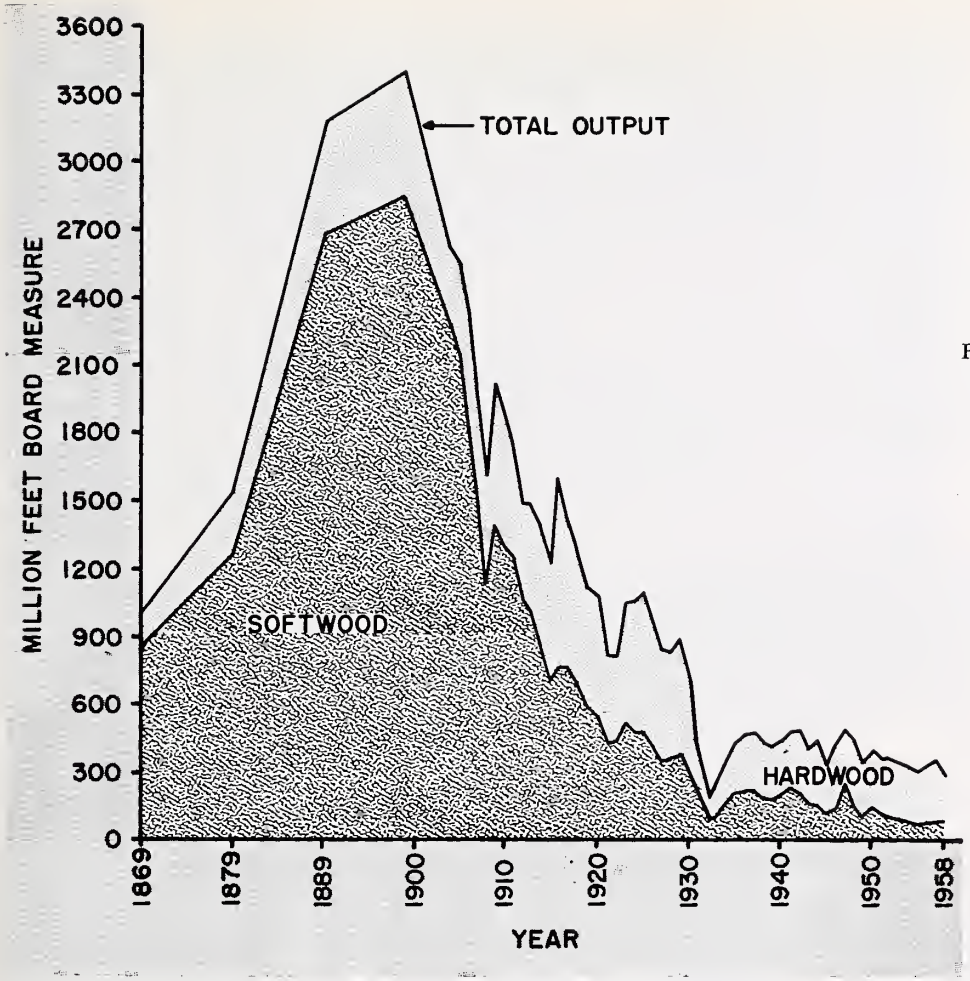


FIGURE 35.—Wisconsin lumber production trend, 1869-1958. (Source for 1869-1946: Lumber production in the United States, 1779-1946, U. S. Dept. Agr. Misc. Pub. 669, 1948.)

Veneer Plants Are Numerous

Wisconsin has more veneer mills than any other midwestern state. In 1956 there were 47 of them. Twenty-one were producing standard veneer for doors, furniture, paneling, and plywood. The other 26 plants made container veneer for cheese boxes, fruit baskets, and similar containers, largely for food packaging. The veneer was produced almost entirely from maple, yellow birch, basswood, oak, and elm logs. Very few large softwood logs are used, and most of these are imported. The standard veneer industry of Wisconsin dates back to 1892 when the first veneer cutting mill started operations at Antigo. The plant was rebuilt after a fire in 1908 and is still operating.

In 1956, the standard veneer plants used 53 million board feet of wood, only 24 million board feet from within the State. The container veneer plants used 14 million board feet, 6 million of which was imported wood. Although the 1956 production of veneer in Wisconsin was one-fifth higher than in 1936, recent stiff competition from paper and plastic food containers threatens some of the important container veneer products. The standard veneer industry is encountering problems in the form of increasing imports of foreign veneer and dwindling local supplies of high-quality large timber. Between 1945 and 1956, imports of veneer logs from outside the Lake States to Wisconsin have risen from 4 million to 10.5 million board feet annually. The limited supply of veneer logs in Wisconsin and nearby States has almost doubled log prices in the last decade and has pushed up costs for veneer makers.

Veneer Log Production Down Slightly

The 1956 production of veneer logs totaled 30.4 million board feet—a decline of about 15 percent since 1936. The veneer cut was nearly all hardwood (appendix table 40). Veneer logs have the highest

value per unit of any of the log products and commonly sell for about two or three times as much as saw logs. Since strong markets exist for quality veneer logs, production is closely tied to the supply of suitable stumpage. In recent years, declining supplies of quality logs and strong competition in the veneer industry are causing a reduction in veneer log output.

Most of the veneer logs are cut in districts at opposite sides of the State (fig. 36). The heaviest cut of veneer logs is made in northeastern Wisconsin, which supplies 31 percent of the total. Leading species in this district are hard maple, yellow birch, elm, and basswood. Across the State, southwestern Wisconsin produces 26 percent of the State's veneer log production; here red oak, hard maple, elm, and basswood are the most important.

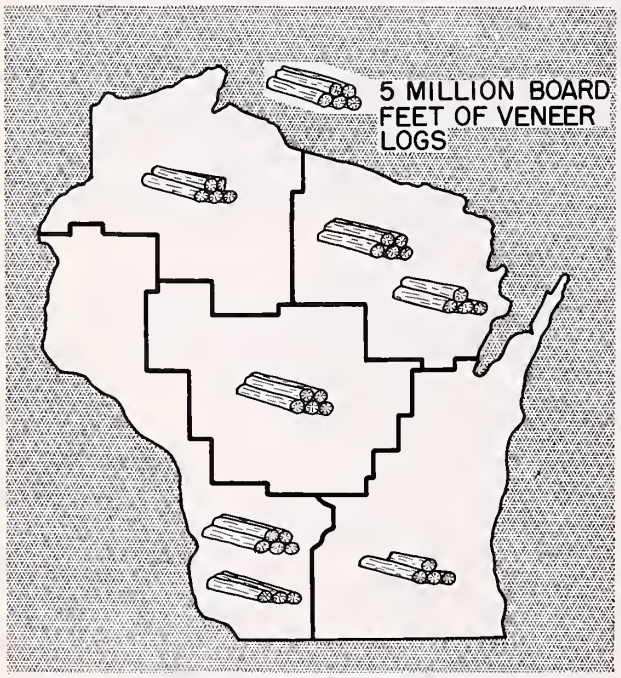


FIGURE 36.—Where the veneer logs were cut in 1956.

Miscellaneous Wood-Using Plants Highly Specialized

Wisconsin has about 50 miscellaneous primary wood-using plants that produce excelsior, charcoal, cooperage, toothpicks, woodenware, clothespins, lath, and shingles. In 1956 they required more than 93 thousand cords of aspen, hard maple, and miscellaneous hardwood timber. Of these plants the excelsior mills use the most wood.

Charcoal Wood Production Small But Climbing

A rather modest charcoal industry has come alive with the increasing popularity of backyard and outdoor charcoal broiling and barbecuing. This new demand, along with new developments in low-cost portable and semi-permanent small kilns operated near the woods, fostered the revival of the industry.

Since 1946, charcoal-wood production has almost tripled—going from 13 thousand cords in 1946 to 38 thousand in 1956. Most of the charcoal wood is shipped to Upper Michigan for processing. Although the amount of wood involved is small, it is generally salvaged from previously unused material such as slabs and edgings, sawtimber tops, and cull logs left during logging.

Production of Roundwood Products Down

The cut of roundwood products that require very little processing—mainly fence posts, poles, piling, and mine timber—has declined in the last 20 years for several reasons. The use of steel posts, the trend toward larger fields on farms, electric fencing, and other factors have cut into the demand on farms for posts, particularly for hardwood posts. Cedar post production has held its own with higher nonfarm demand for rustic fencing and outdoor furniture and for highway and park construction.

In 1956, over 10 million fence posts, 25,000 poles, 2,900 pieces of piling, 9,000 hewn ties, and 4,600 cords of mine supports were produced, largely by small producers. Generally, posts entering commercial channels were made from softwoods, particularly cedar and treated pine, and were distributed as far away as North Dakota and Iowa. Since 1956, there has been a marked increase in pine pole production (fig. 37). Mine timber production varies year by year but has remained relatively stable since 1936; increasing use of substitute materials and wood preservatives, however, has made inroads in the amount of wood used in underground mining operations.

Fuelwood use is decreasing in Wisconsin. In the last 20 years, the State's output has dropped from 3.2 million cords to 1.3 million cords, although more wood was cut for fuelwood in 1956 than for any other product. However, three-fourths of the fuelwood was cut from cull and dead trees; limbs, slabs, and other mill wastes; and small trees.

Fuelwood no longer has significant commercial importance since little is bought or sold. The last major stronghold for fuelwood is the farm home where the wood is cut on the farm or nearby—generally, during the "off seasons." Even on the farms, fuel oil, gas and electricity are gradually replacing wood for fuel.

FIGURE 37. — The Penta Wood Products, Inc., yard at Siren began pressure-treating utility poles and posts in 1953. About 15,000 cords of red and jack pine were treated here in 1958 and distributed across the Middle West. (Photo courtesy of Penta Wood Products, Inc.)

The 1956 Timber Cut[3]

Long-Term Cut Shows Stability

The overall trend for timber cut from growing stock shows a moderate decline. The total cut in 1936 exceeded the 1956 cut by 7 percent, but the 1948 cut was higher than for either of these years. Although variations in weather and markets caused most of these fluctuations in overall cut, changes in demand have brought some species into wider use; other species, because of lower supply, are now less important commercially than they were in 1936. Current harvesting takes a somewhat smaller percentage of the growing stock than was taken in the 1930's, a reflection of increased annual growth.

Annual Harvest Exceeds 3½ Million Cords

About 2.3 million cords of timber were cut from growing stock in 1956, including about 404 million board feet of sawtimber. Another 1.3 million cords were harvested from cull trees, dead timber, trees smaller than merchantable size, hardwood limbs, and from noncommercial forest sources such as shade and fencerow trees. Nearly all of the saw logs, veneer logs, pulpwood, piling, and poles came from growing-stock timber, while most of the nongrowing-stock material went into fuelwood and fence posts.

Timber Cut One-Third Aspen

The cut of aspen has tripled since 1936 (fig. 38). Aspen, considered a weed species suitable only for fuelwood and temporary fence posts as late as 1940, has become the major commercial species in terms of volume used. In 1956, 34 percent of the cut was aspen—more than three-fourths of a million cords. It had been known since the early thirties that pulp made from aspen was highly useful, although fiber yields per cord were comparatively low. Aspen was accepted as a pulp species during the forties because of the rising cost of conifer pulpwood, increased market for paper products, development of processes where aspen is preferred, and pulpwood transport problems during World War II. Since then, the use of aspen in the pulp and paper industry has never slackened.

Softwood Cut Is Off

The cut of softwoods has dropped from the 1936 harvest of 1,085,000 cords to 457,000 cords in 1956. A decline in the cut of hemlock, the leading conifer species in 1936, caused most of the downward trend. However, the harvest from spruce, balsam fir, tamarack, and cedar is also below the 1936 rate (fig. 38).

Trends in cut reflect more and more the availability

[3] The total timber cut discussed in the text is for 1956, although for certain key products such as lumber and veneer logs, and pulpwood, more recent information is available. Some tables and charts will show information through 1958.

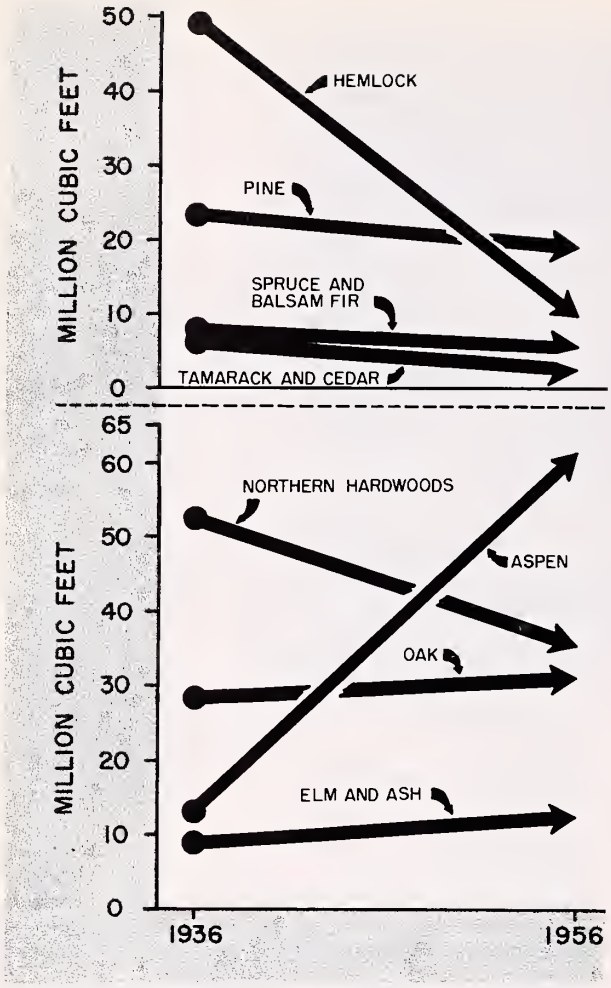


FIGURE 38.—Trends in timber cut by species.

of timber supplies. Hemlock cut has declined primarily because the old-growth hemlock has been removed and the remaining supply is scattered or mixed in with poletimber hardwoods. On the other hand, aspen supplies are large and stands of pulpwood size are widespread. In recognition of this situation, wood processors have expanded their use of aspen very rapidly. A closer correlation between timber supply and timber cut should occur as markets expand. If this happens, the harvest of oak, elm, and ash should rise.

Two-Thirds of Cut in Four Species

Aspen, red oak, hard maple, and jack pine provided two-thirds of the 1956 cut. Aspen and jack pine went primarily into pulpwood and box lumber; red oak, and hard maple were the leading saw log species. About 54 percent of the poletimber cut was aspen. Red oak, second only to aspen in total cut, supplied the largest volume of saw logs—more than 75 million board feet. Most red oak went for lumber, ties, and fuelwood. Saw logs in the amount of 59 million board feet were cut from hard maple—the third ranking species. Jack pine, the fourth ranking species in total cut, supplied one-third of the softwood harvest, although both hemlock and white pine supplied more saw logs.

About Half of the Cut From Sawtimber Trees

About half of the 1956 timber cut was from sawtimber and half from poletimber trees, with the scales tipped slightly in favor of poletimber (fig. 39). Harvest of sawtimber trees amounted to 1.1 million cords including upper stems, and contained 404 million board feet of saw log material. The poletimber cut totaled 1.2 million cords. In 1936 the sawtimber cut exceeded the poletimber harvest by 10 percent. Thus, the 1936 sawtimber-poletimber cut relationship has reversed.

Majority of Timber Cut In Northern Wisconsin

Timber cutting in Wisconsin is supply-oriented. Northeastern and northwestern Wisconsin have three-fifths of the forest land and three-fifths of the volume, and produced three-fifths of the 1956 timber cut.

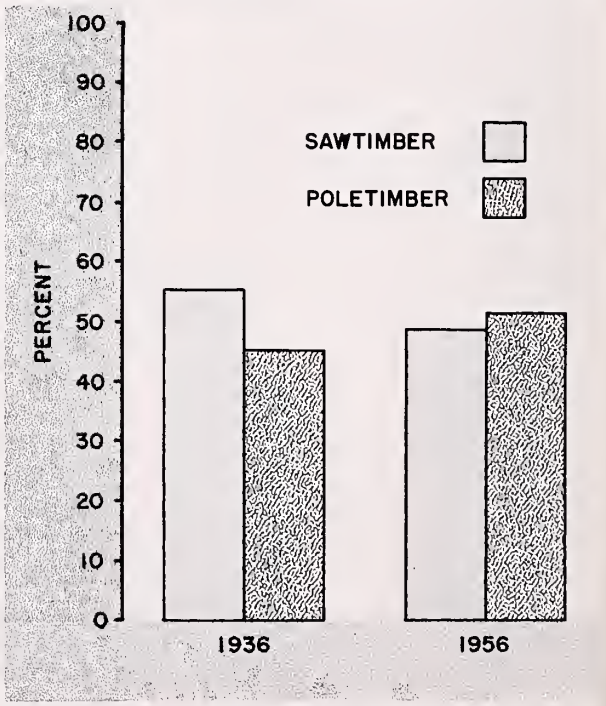


FIGURE 39.—Poletimber cut is now more than the sawtimber harvest.

The other districts (central, southeastern, and southwestern) have two-fifths of the total forest land and timber volume, and produce two-fifths of the timber cut. Central Wisconsin, an important pulpwood-producing area, had a total cut of 470,000 cords.

Four-Fifths of the Timber Cut on Private Land

Privately owned commercial forest land provides the backbone of timber supply in Wisconsin. In 1956 four-fifths of the total timber cut came from these lands, although private acreage is just two-thirds of the total. The public forests, which include one-third of the commercial forest area and three-tenths of the timber volume, produced one-fifth of the 1956 timber cut. The apparent undercutting on the public forests is caused largely by two factors: Many areas on the public forests are below adequate stocking, and growth is being accumulated to improve forest production.

Fuelwood and fence posts, which make up a large part of the total cut, come primarily from farm woodlots—often from low-grade hardwoods with little commercial value. Aspen and the softwoods comprise a greater part of the timber cut on public land than on private holdings. Much the same pattern exists for the harvest of saw logs. Except for yellow birch and aspen, the saw log cut on private land contained more hardwoods than that from public forests.

Some pulpwood bolts are now peeled in the woods before being transported to the mill. (Photo courtesy of Wisconsin Conservation Department.)

THE TIMBER BALANCE

Changes in volume are brought about by growth, timber cut, and natural losses. As with any other crop, the amount of wood that can be harvested year after year is limited to the amount that can be grown. The wood crop differs, in that the harvest is not a single year's growth but part of the growth from many years. The cut comes primarily from the larger trees. These are in turn replaced from a chain of small-sized trees. Any deficiencies in this chain of sizes in any one of the species can cause irregularities in wood supply. One of the major goals of forest management is to balance size classes. Since comparisons of cut to growth do not take into account the variations in the flow of sizes, the concept of allowable cut was formulated. Allowable cut is the level of cutting that can take place while improving the size-class balance and bringing the forests nearer full production.

Current allowable cut (1956-65)[4] in Wisconsin for all growing stock is 2.5 million cords annually, including 440 million board feet of sawtimber (appendix table 25). Net growth exceeds the allowable cut by 1.2 million cords or 49 percent. Where forests are young and understocked, a large part of the growth is needed to increase total volume and thus improve forest stocking (and future growth). As the forests approach full stocking, allowable cut can be increased until it equals growth.

Cut Can Be Higher in Some Places and in Certain Species

In 1956, the actual timber cut from growing stock was less than the allowable cut. The surplus (difference between allowable cut and timber cut) in aspen and the other hardwoods, amounted to 290,000 cords; the softwoods were slightly overcut. Net growth in both hardwoods and softwoods was well above the timber cut (fig. 40).

In 1956, the timber cut from sawtimber could have been increased since the actual sawtimber cut totaled 92 percent of the allowable cut. However, this favorable overall balance conceals heavy cutting of key species, overcutting of large-diameter timber, and excessive logging in some areas.

Hardwood Sawtimber Cut Can Be Larger

The allowable cut of hardwood sawtimber exceeded the timber cut in 1956 by 41 million board feet. The cut from softwood saw log-size material surpassed the allowable cut slightly because of heavy drain on hemlock, jack pine, and balsam fir. Every district but central Wisconsin had a small surplus of sawtimber, with the southwestern district having the most opportunity for increasing the cut:

	Allowable Cut	Timber Cut
	(Million board feet)	
Northeastern Wisconsin	144	133
Northwestern Wisconsin	98	82
Central Wisconsin	51	77
Southeastern Wisconsin	35	30
Southwestern Wisconsin	114	82

Most of the sawtimber surplus is in a few species. Two-thirds is aspen, with elm, white oak, ash, paper birch, white pine, red pine, and cedar having some excess volume. In northern Wisconsin, hard maple sawtimber cut exceeded the allowable cut by 7.4 million board feet, while a small surplus of soft maple, yellow birch, and red oak occurred. In central Wisconsin, red oak and jack pine sawtimber were overcut during 1956. In southern Wisconsin, surpluses were present in all major sawtimber species with the exception of hard maple. In general, the higher grades of sawtimber are fully harvested. Most additional cutting is possible in remote or scattered timber, in trees containing a large portion of low-grade logs, and in mature stands of small sawtimber, particularly aspen.

Cut of Major Pulp Species High

The principal pulpwood species—jack pine, spruce, balsam fir, hemlock, and aspen—are heavily cut in Wisconsin. During 1956, the cut in jack pine and hemlock exceeded allowable cut. Overcutting of softwood pulpwood species occurred in every district where softwoods are fairly plentiful. The following tabulation compares the allowable cut and 1956 timber cut of the principal softwood species and aspen by Forest Survey District.

[4] Allowable cut is the volume of merchantable live sawtimber and poletimber that should be cut during a given period while building up or maintaining sufficient growing stock to meet specified growth goals. Several factors including distribution of forest areas by types, species composition, and size classes, together with the less tangible factors of operability and market demand, influence the determination of allowable cut. Because of the variable conditions encountered in Statewide inventory sampling, all factors that would actually determine allowable cut on a managed forest could not be applied. But in order to be as realistic as possible, field crews judged sampled stands for allowable cut about as they would for a prospective timber sale, weighing operability as well as silvicultural factors. A stand was not considered operable unless the volume recommended for cutting amounted to 1,500 board feet of sawtimber, or 3 cords of poletimber, or a combination of the two equal to 3 cords per acre.

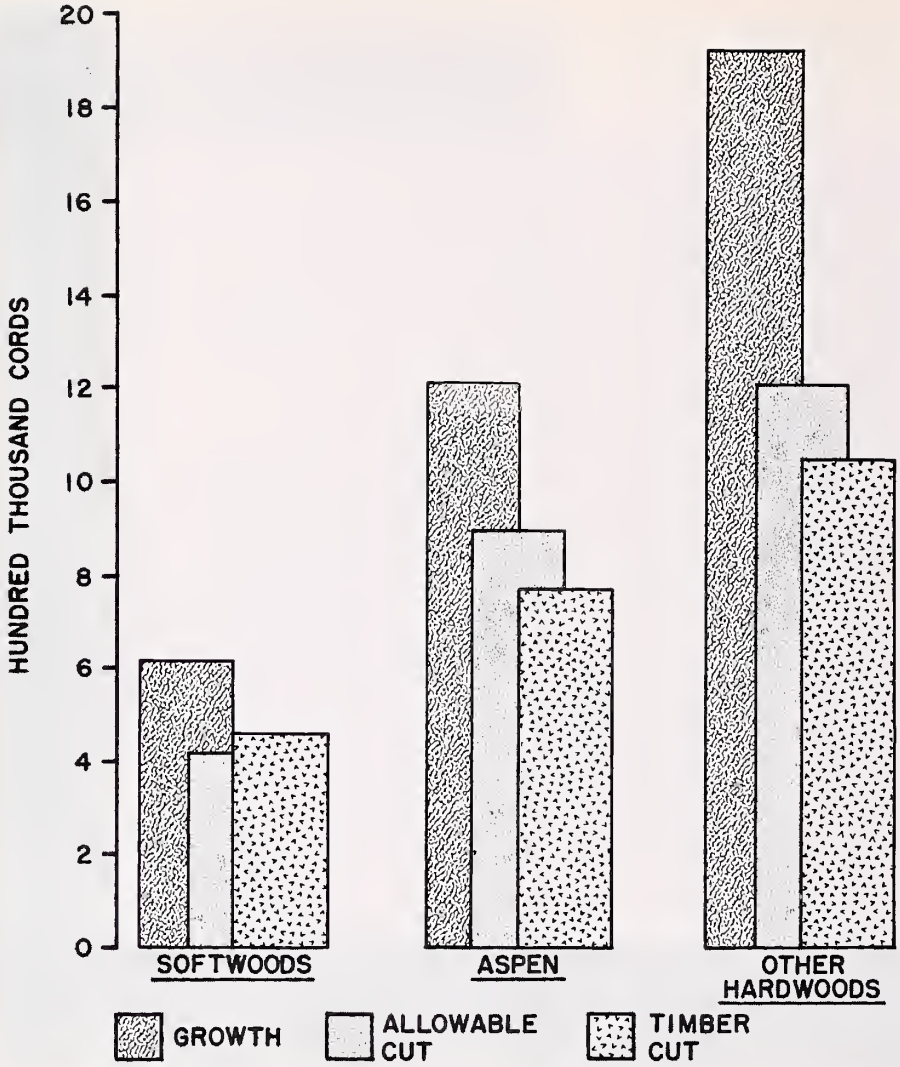


FIGURE 40.—Net growth, allowable cut, and timber cut for softwoods, aspen, and other hardwoods.

	Principal pulpwood species Allowable cut	Timber cut
	(Thousand cords)	
Northeastern Wisconsin		
Softwoods	115	134
Aspen	356	339
Total	471	473
Northwestern Wisconsin		
Softwoods	77	109
Aspen	380	289
Total	457	398
Central Wisconsin		
Softwoods	34	96
Aspen	87	128
Total	121	224
Southern Wisconsin		
Softwoods	5	2
Aspen	73	14
Total	78	16

In central Wisconsin, where 10 of the State's 29 pulpmills are located, the cut of softwood pulpwood species was nearly triple the allowable cut; in northeastern Wisconsin it was 17 percent higher, and in northwestern Wisconsin the softwood cut was 42 percent above the allowable cut. The 1956 cut of the principal softwood pulpwood species in the central district was almost double the softwood total growth. If key softwood species are to be maintained in this area, heavy planting and intensive forestry must be practiced or the cut reduced. Central Wisconsin has many fine plantations that are beginning to provide intermediate thinnings; as the trees mature they will contribute increasing supplies of wood.

Poletimber Cut Can Increase in Less-Used Species

Wisconsin has a surplus of poletimber in several species not widely used for pulpwood. In 1956, 230,000 more cords could have been cut from pole-

timber in species other than the major pulpwood species as shown in the following tabulation.

	Poletimber excluding pulpwood species	
	Allowable cut	Timber cut
	(Thousand cords)	
Northeastern Wisconsin		
Softwoods	19	16
Hard hardwoods	49	60
Soft hardwoods	97	34
Total	165	110
Northwestern Wisconsin		
Softwoods	11	6
Hard hardwoods	58	41
Soft hardwoods	88	32
Total	157	79
Central Wisconsin		
Softwoods	3	3
Hard hardwoods	40	64
Soft hardwoods	27	19
Total	70	86
Southeastern Wisconsin		
Softwoods	6	3
Hard hardwoods	35	17
Soft hardwoods	22	10
Total	63	30
Southwestern Wisconsin		
Softwoods	1	1
Hard hardwoods	101	59
Soft hardwoods	43	8
Total	145	68

The key pulpwood species, with the exception of aspen, were in short supply in the poletimber sizes, and timber cut exceeded allowable cut for two—jack pine and spruce. A small surplus of balsam fir poletimber occurred in the two northern districts. For hardwood poletimber, in general, the cut can be higher, although the cut should come from thinnings and improvement cuts—not from clear cutting. Only hard maple was subjected to overcutting in 1956. The cut of two species—paper birch and aspen—was 252,000 cords below allowable cut in 1956. The cut of hardwood poletimber can increase in every district except central Wisconsin. The largest surplus species is paper birch, particularly in northeastern Wisconsin. About 125,000 cords more paper birch can be harvested annually without exceeding the allowable cut. The cut of aspen poletimber can also be higher. Nearly 100,000 cords more aspen can be harvested annually, three-fourths of it in northwestern Wisconsin.

Nicolet National Forest, 1960. A year ago both sides of this road were logged in a thinning and improvement cutting timber sale. Logging, properly handled, is usually compatible with other uses.

THIRTY-YEAR OUTLOOK

By 1986 timber volume will increase an estimated 43 percent, saw log volume 71 percent, net growth 33 percent, and timber cut 40 percent over 1956 if recent trends continue. In general, the forests will be better stocked and more productive than they are now.

Projected timber volume, growth, and cut have been estimated for 1966, 1976, and 1986 (appendix table 41). These projections carry the assumptions that annual timber products output in Wisconsin will rise with estimated increases in population and national income; that wood will maintain its relative position in the national economy; that forestry will continue to advance at the rate indicated by recent trends, and that utilization will improve, i.e., more of the wood cut will end up in useful products. The trends are also predicated upon anticipated greater timber product demands by industry, continuing reforestation, a "thickening up" of natural stands, and other changes leading to a more productive forest and hence a higher allowable cut.

These projections are inherently speculative since future changes in the forest resource situation depend on numerous forces and factors. The forests of Wisconsin are capable of producing far more wood than the anticipated production during the next 30 years. The size of the improvements that will occur in the next few decades depends largely on the caliber of forestry applied, particularly on the 9 million acres of small private woodlands.

Wisconsin's large forest industries import considerable wood, mainly from Michigan and Minnesota, but increasing supplies of raw material within the State can be expected to be tapped. Trends in product use give a varied pattern. These changes, along with changes in timber supply, will influence the complexion of industry expansion. Since total wood production will accelerate faster than log-quality improves, those industries that use wood fiber, such as the paper and fiberboard companies, will be able to expand before the veneer and lumber producers detect improvements in supplies of high-quality logs.

Among the current changes in product use is a decline in fuelwood and fence posts. Greater use of mill and logging residue, mainly as pulp chips, with some gain in charcoal production, is expected. Increases in pulpwood and saw log production are expected to more than offset lower use of posts and fuelwood. Greater local production of dense hardwood pulpwood will reduce somewhat out-of-State procurement of pulpwood. Both eastern Upper Michigan and northeastern Minnesota, which presently supply much of Wisconsin's imported wood, have surpluses of pulpwood and other favorable factors making them potential pulpmill locations. Increased pulping capacity in either of these areas will tend to lower the supplies of wood now available to Wisconsin mills.

Long-range improvements in the timber resource should lead to expansion of Wisconsin's forest industries. A 7-percent increase in pulpmill capacity between 1956 and 1959 reflects this trend.

Generally, effective steps have been taken on public and industrial forests to guarantee increasing future wood production. Controlled timber cutting, reforestation, insect and disease control, fire protection, and stand improvement are some of the measures being applied to these ownerships with conscious effort to improve future forest productivity. Most of the public and industrial lands are located in northern Wisconsin. Because of advances in forest management, forests in this area should improve more rapidly than those down State.

On small private holdings much less is being done to improve or maintain timber production. Less improvement is expected in the timber held by private owners, particularly in southern Wisconsin where markets are limited for less valuable but common species. These species have accumulated in the stands, resulting in many poorly stocked stands of low-quality, defective sawtimber. The direct management assistance provided forest owners by the Wisconsin Conservation Department and the educational efforts of the State extension foresters play an important role in this problem area. Here Agriculural Conservation Programs, providing cost-sharing in tree planting and timber stand improvement, can stimulate sound practices.

A number of factors looming on the horizon will influence the timber situation in the next few decades. Population increases will expand wood markets. Inroads into land now in timber production can be expected for a variety of uses including roadways, utility lines, urban and suburban expansion, park and recreational facility development, airfields, and farmland expansion. The extent of these changes is unknown

but the trends seem toward less land available for wood production, both in total and per capita.

To counter this change are advances in technology and research, in equipment and the number of trained forest managers, that open the way toward better management of the available forest area. Efforts to increase the productivity of the forests will have to be sharpened to put emphasis where the chances of future yields are greatest if growing demand for wood products and forest land are to be met. The wood products harvested in Wisconsin in the next 30 years must come from trees already in the stands. The care that this crop gets will determine the resource base that forest industries can tap for raw material through the 1980's.

Two new factors appearing since the completion of the second Forest Survey promise to favorably influence the future timber situation. The first is the Forest Pest Control Law. Its provisions provide for the control of serious outbreaks of timber-destroying insects and diseases. The second is the sharp upswing in reforestation now approaching 60,000 acres per year.

The outlook in brief seems toward a timber resource of slightly smaller acreage, producing more wood of improving quality, for a gradually expanding forest industry complex.

APPENDIX

Forest Survey Methods

Area

The proportion of forest and nonforest area in Wisconsin was measured on aerial photos. Selected locations (40-acre blocks in the north and 1-acre samples in the south) were classified as forest or nonforest. A part of these blocks and dots were checked on the ground to confirm or correct the accuracy of the photo-classification.

The breakdown of forest area by condition class was done in two ways:

Random block sampling—In northwest, northeast, and central Wisconsin, area estimates were based upon sample blocks selected at random. Forty-acre sample blocks (36 to 54 per township) were used. All of the land on each of the sample blocks was photo-interpreted as to forest type, stand-size, and density. A portion of these were then checked on the ground to confirm or correct the photo-interpreter's classification. The changes made as a result of the ground check were extended to correct the photo-classification of the sample blocks that were not ground-checked.

Dot sampling—A dot-sampling system was used in the sparsely forested area in southeastern and southwestern Wisconsin. A portion of the 1-acre dots used to determine the proportion of forest and nonforest area were further examined under the stereoscope and classified as to size and density. Next, a sample of the stereo-examined points was selected and checked in the field; these ground checks were then used to adjust the data on the samples that were not ground-checked.

On all U. S. Forest Service lands detailed forest-type maps were made.

Ownership

Forest area ownership was obtained by examination of county ownership records at county offices to determine the ownership category for each sample location.

Volume and Growth

Volume and growth were computed from measurements collected on 12,861 one-fifth-acre circular plots which were part of the ground-checked samples. These plots supplied the information on distribution of volume by species and diameter classes within each mapped condition class. The resulting per-acre volumes and growth multiplied by area gave total volume and growth by species and diameter class for each condition class.

Allowable Cut

Allowable cut represents the timber volume that can be cut annually during the next 10 years while maintaining (or building toward) a desirable level of growing stock. It is developed in two parts:

1. Harvest cuts in even-aged stands were computed in the office after inventory and growth data had been processed.
2. Harvest cuts in uneven-aged stands, and all thinnings, intermediate cuts, and salvage operations were computed in the field on the basis of conditions found on sample plots.

Even-aged stands.—In even-aged stands the annual harvest cut is governed by:

1. The present area, volume of timber, and current growth in mechantable-size classes.
2. The calculated liquidation period which is controlled by
   a. The assumed totation, and
   b. The area distribution of size classes.

The rotations used were those commonly accepted for the various even-aged types.

The volume that might come from thinnings and salvage operations in even-aged stands was determined by the field foresters on the sample plots. Only practical operations were recommended: a minimum cut of 1,500 board feet of sawtimber, 3 cords of poletimber or a combination of the two equal to 3 cords per acre of merchantable wood.

Uneven-aged stands.—Intermediate cuts and harvest cuts in uneven-aged stands were also estimated on the sample plots by the field foresters. The first step in determining allowable cut on each plot was to decide whether an operable cut could be made during the next 10 years. If a cut was indicated, the field men made essentially a "cut and-leave" tally of the trees, basing the cut on:

1. Silvicultural system appropriate to the site and type.
2. Level of growing stock found on the plot.
3. Operability considerations.

A tally of the trees to be cut divided by the years in the allowable cut period gave the annual allowable cut for the sample plots.

As a check on the formula method used for harvest cuts in even-aged stands (described above) and as a basis for determining the cut by species, a "cut-and-leave" tally was also made in even-aged stands. The results of this sample permitted closer analysis of the allowable cut for even-aged stands and more information about the kind of material that should be removed.

Timber Cut

All sawmills, pulpmills, veneer mills, and other wood-using industries were canvassed by mail or interviewed to estimate the volume of primary forest products. Other surveys were made to estimate fuelwood and fence post production. Studies were also made of timber residues to adjust forest products estimates to timber cut in terms of inventory volumes. In addition, public agencies reported the amount of wood sold during the sample year, and this information was used to break down the total timber cut by ownership.

Accuracy of Survey

Area

There were two sources of error in estimating the area of forest land: (1) errors in classifying the type, size, and density classes and in compiling the data, and (2) sampling errors. A special effort was made to keep all errors of classification and measurement, in both field and office, to a minimum. The degree of human errors cannot be measured. Statistical errors, which vary with sampling procedures and sample size, were kept as low as available funds would permit. The sampling intensity was sufficient to provide an estimate of the forest area with a sampling error of about $\pm$ .33 percent or $\pm$ 1.3 percent per million acres (one standard deviation).

Volumes

The sources of error in estimating timber volume include: (1) Errors in measurement of plot radius, tree diameter, height, and cull; (2) improper construction or use of tree volume tables; (3) errors in recording or compiling the plot data; and (4) sampling errors. As in the area determinations, every effort was made to minimize the effect of such errors through continuous supervision and training. The number of volume plots taken in the State was sufficient to provide a sampling error for total volume of $\pm$ .46 percent or $\pm$ 1.8 percent per billion cubic feet (one standard deviation).

For a single forest type, species, ownership, or condition class, the sampling error is considerably higher. Generally, the smaller the area or volume, the higher the sampling error would be.

Definition of Terms

Land-Use Classes

Forest land area.—Land at least 10 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. (Forest tracts of less than 1 acre, isolated strips of timber less than 120 feet wide, and abandoned fields and pastures not yet 10 percent stocked are excluded.)

Commercial forest land area.—Forest land which is producing, or capable of producing, crops of industrial wood and not withdrawn from timber utilization.

Noncommercial forest land area.—Unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions, and productive public land withdrawn from commercial timber use through statute or administrative regulation.

Forest Types

A forest type is characterized by the predominance of certain key species. Predominance means that in sawtimber stands 50 percent or more of the saw log volume is of the key species; in poletimber stands 50 percent or more of the cordwood volume; and on restocking areas 50 percent or more of the small trees. However, each type contains some transitional areas in which no species makes up 50 percent. In these places, the classification is based upon species with the majority volume or number.

White pine type.—Fifty percent or more of the stand is eastern white pine (common associates include red pine, jack pine, and aspen).

Red pine type.—Fifty percent or more of the stand is red pine (common associates include eastern white pine, jack pine, and aspen).

Jack pine type.—Fifty percent or more of the stand is jack pine (common associates include eastern white pine, red pine, and aspen).

Black spruce type.—Swamp conifer forest stand in which 50 percent or more of the stand is black spruce (common associates include tamarack, balsam fir, and white-cedar).

Tamarack type.—Swamp conifer forest stand in which 50 percent or more of the stand is tamarack (common associates include black spruce and white-cedar).

Cedar type.—Swamp conifer forest stand in which 50 percent or more of the stand is white-cedar (common associates include balsam fir, black spruce, and tamarack). Includes a very small acreage of redcedar.

Spruce-fir type.—A mixed conifer stand in which 50 percent or more of the stand is white spruce and balsam fir, singly or in combination (common associates include black spruce, white-cedar, American elm, aspen, red maple, and paper birch).

Northern hardwood type.—Fifty percent or more of the stand is sugar maple, yellow birch, beech, hemlock, and basswood, singly or in combination (common associates include American elm, red oak, aspen, red maple, and paper birch).

Lowland hardwood type.—Fifty percent or more of the stand is black ash, green ash, red maple, American elm, slippery elm, balsam poplar, silver maple, and cottonwood, singly or in combination (common associates include basswood, and aspen).

Oak type.—Fifty percent or more of the stand is one or more species of oak (common associates include hickory, basswood, and American elm).

Aspen-birch type (or aspen type).—Fifty percent or more of the stand is trembling or large-tooth aspen, and paper birch, singly or in combination (common associates include jack pine, balsam fir, and white spruce).

Grass and brush (also called nonstocked).—Forest land having less than 10 percent of the growing space effectively used by trees. Includes upland and lowland brush and grass.

Species Group

Softwoods.—Includes white pine, red pine, jack pine, white spruce, black spruce, balsam fir, tamarack, northern white-cedar, eastern redcedar, and hemlock.

Hardwoods.—All commercial deciduous species including the aspens, unless otherwise specified.

Northern hardwoods.—Includes sugar maple, yellow birch, beech, and basswood.

Stand-Size Classes

Overstories were given precedence except when of poor density (10 to 40 percent) or of a light defective stand of aspen. In pulpwood types (spruce-fir, aspen, jack pine, black spruce, tamarack, and cedar) pole stands ranked even with sawtimber and took precedence if of substantially better density. If sawtimber volume was about equal to poletimber volume, the stand was classified as sawtimber. In mixed stands, stocking was based on *total* stocking.

Sawtimber stands.—Stands with sawtimber trees having a minimum net volume per acre of 1,500 board feet, International ¼-inch rule.

Poletimber stands.—Stands that fail to meet the sawtimber-stand specification but that are at least 10 percent stocked with poletimber and larger (5.0 inches and larger) trees, and with at least half the minimum volume in poletimber trees. (Poletimber stands carry at least 3 cords—240 cubic feet per acre).

Seedling and sapling stands.—Stands not qualifying as either sawtimber or poletimber stands, but having at least 10 percent stocking of trees of commercial species, and with at least half the minimum stocking in seedling and sapling trees.

Nonstocked.—Lands qualifying as forest but with too little tree cover to meet the specifications for sawtimber, poletimber, or restocking stands.

Tree Classifications

Sawtimber trees.—Trees of commercial species with at least one merchantable saw log of the following minimum diameters at breast height (d.b.h.): Softwoods 9.0 inches and hardwoods 11.0 inches. Merchantable saw logs are at least 8.0 inches in diameter inside bark at the small end and 8 feet or more in length, with at least 40 percent usable volume, and suitable for sawing into standard lumber, construction timbers, or ties.

Poletimber trees.—Trees of commercial species in the following d.b.h. range: softwoods 5.0 to 8.9 inches, hardwoods 5.0 to 10.9 inches with more than 40 percent usable volume.

Seedlings and saplings.—Trees of commercial species below 5.0 inches d.b.h.

Cull trees.—Live trees of sawtimber or poletimber size with 60 percent or more of their gross volume unusable due to defects or deformities.

Diameter Measurements

Diameter at breast height (d.b.h.).—The diameter of a tree at 4.5 feet above average ground level.

Diameter class.—Trees in a 2-inch diameter range, each class including diameters 0.9 inch higher and 1.0 inch below the midpoint of the class—e.g., the 6-inch class would include trees from 5.0 to 6.9 inches d.b.h.

Volume Classifications

All timber volume.—Net volume in cubic feet of all live and salvable dead sawtimber trees and poletimber trees of commercial species, and cull trees of

all species from stump to a minimum 4.0-inch top diameter inside bark found on commercial forest land. Includes only the main stem of softwood to a minimum of 4.0 inches diameter inside bark, but both main stem and limbs of hardwoods to a minimum .4.0-inch diameter inside bark.

Sawtimber volume.—Net volume in board feet, International ¼-inch rule, of live sawtimber trees on commercial forests. Minimum top diameter is 8 inches.

Cordwood volume.—Net volume in poletimber trees and upper stems of sawtimber trees measured in 4x4x8-foot cords containing approximately 80 cubic feet of peeled wood.

Growing stock volume.—Net volume of the central stem of live sawtimber trees and live poletimber trees from stump to a minimum mechantable 4.0-inch diameter. Excludes dead trees, cull trees, and limbs.

Pulpwood volume.—The total growing stock volume of black spruce, white spruce, balsam fir, jack pine, hemlock, and aspen.

Growth

Net annual growth.—The annual change in volume of sound wood in live sawtimber and poletimber trees during a specified period resulting from natural causes.

Ingrowth.—The merchantable volume of all trees that will grow into growing stock annually.

Mortality

Mortality of growing stock.—The volume of sound wood in live sawtimber and poletimber trees dying annually from natural causes.

Annual Allowable Cut

The volume of live sawtimber and poletimber that can be cut annually during a given period while building up or maintaining sufficient growing stock to meet specified growth goals.

Timber Cut

Annual cut of growing stock.—The net cubic-foot volume of live sawtimber and poletimber trees cut or killed by damage due to logging, or by land clearing and cultural operations, on commercial forest land during a specified year.

Annual cut of sawtimber.—The net board-foot volume of live sawtimber trees cut or killed by logging, and by land clearing and cultural operations on commercial forest land during a specified year.

Timber products output.—The volume of rough forest products cut from growing stock, cull and dead trees, limbwood, etc.

Logging residues.—The net cubic-foot volume of live sawtimber and poletimber trees cut or killed by logging on commercial forest land and not converted to timber products.

Log Grades—Specifications for lumber log grades are as follows:[1]

Grade factors	Grade 1				Grade 2			Grade 3
	Hardwood (except aspen)		Red and white pine	Aspen	Hardwood (except Aspen)	Red and white pine	Aspen	All species
	Butts only	Butts and uppers						
Diameter (minimum) small end of log.....inches.....	[2]13	[2]16	16	9	[2]11	12	9	8
Length (minimum).....feet.....	10	10	10	8	8	10	8	[3]5
Clear cuttings (on the 3 best faces):								
Length (minimum).....do.....	7	5	.....	.....	3	.....	.....	2
Number on face.....	2	2	.....	.....	2	.....	.....	([4])
Yield in face length (each of 3 faces).....	5/6	5/6	3/4	4/4	4/6	1/2	.....	3/6
Yield in face length (each of 2 faces).....	.....	.....	.....	.....	.....	3/4	4/4	.....
Sweep and crook deduction (maximum).....percent.....	15	15	.....	.....	30	.....	.....	50
Total defect, including sweep (maximum).....do.....	40	40	25	0	50	50	30	60

[1] Ties and timber logs are not graded on a "cutting" basis but on diameter and length specifications. The following minimum rules apply: Sound knots are permitted if diameter of the knot collar (flush with surface of the log) is not more than 1/3 of log diameter at that point; whorls or grouped knots are allowed if their aggregate collar diameters occurring within a 6-inch vertical distance do not exceed 1/3 of the log diameter at that point; and any number of sound defects of any size are permitted if they can be slabbed off. No unsound internal defect is permitted, and sweep, in inches, must not exceed ¼ d. i. b. at small end of the log.

[2] For basswood and ash, drop 1 inch in d. i. b.: 12, 15, and 10.

[3] Only 5 feet merchantable length is required except in a 1-bolt tree where a minimum of 8 feet is required.

[4] Unlimited.

Sources: From Hardwood Log Grades for Standing Timber, U. S. Forest Prod. Lab., Rpt. D-1737, 60 pp., 1949; Interim Specifications for Ties, Timbers, or Construction Material (unpublished), U. S. Forest Serv., 1948; and Official Grading Rules for Northern Hardwood and Softwood Logs, Northern Hemlock and Hardwood Mfrs. Assn., 12 pp., 1943. (Softwood Log Grades of Prime, No. 1, and No. 2 correspond to Log Grades No. 1, No. 2, and No. 3 above respectively)

Principal Commercial Forest Trees Recorded on the Wisconsin Forest Survey

Tallied as—

Softwoods:	Botanical name
Eastern white pine	*Pinus strobus*
Red pine	*Pinus resinosa*
Jack pine	*Pinus banksiana*
Black spruce	*Picea mariana*
White spruce	*Picea glauca*
Balsam fir	*Abies balsamea*
Tamarack	*Larix laricina*
Northern white-cedar	*Thuja plicata*
Eastern redcedar	*Juniperus virginiana*
Hemlock	*Tsuga canadensis*
Hard Hardwoods:	
Sugar (hard) maple	*Acer saccharum*
Yellow birch	*Betula alleghaniensis*
Paper birch	*Betula papyrifera*
River birch	*Betula nigra*
Rock elm	*Ulmus thomasii*
Beech	*Fagus grandifolia*
Red oak	*Quercus rubra*
Black oak	*Quercus velutina*
White oak	*Quercus alba*
Jack oak	*Quercus ellipsoidalis*
Bur oak	*Quercus macrocarpa*
White ash	*Fraxinus americana*
Hickory	*Carya spp.*
Black walnut	*Juglans nigra*
Soft Hardwoods:	
Aspen	*Populus grandidentata and Populus tremuloides*
Red maple	*Acer rubrum*
Silver maple	*Acer saccharinum*
Basswood	*Tilia americana*
American elm	*Ulmus americana*
Slippery elm	*Ulmus rubra*
Balsam poplar	*Populus balsamifera var. balsamifera*
Cottonwood	*Fraxinus nigra*
Black ash	*Populus deltoides*
Black cherry	*Prunus serotina*
Butternut	*Juglans cinerea*

TABLE 1.—Area of major land classes by Forest Survey district, Wisconsin, 1956

(Thousand acres)

Class of land	Total	Northeastern Wisconsin	Northwestern Wisconsin	Central Wisconsin	Southeastern Wisconsin	Southwestern Wisconsin
Forest:						
Commercial	15,396	4,157	5,197	2,875	941	2,226
Productive-Reserve[1]	29	0	9	20	0	0
Unproductive[2]	163	39	43	79	1	1
Total	15,588	4,119	5,249	2,974	942	2,227
Nonforest[3]						
Farm	16,826	1,140	1,098	3,557	6,203	4,828
Other	2,597	365	471	717	721	323
Total	19,423	1,505	1,569	4,274	6,924	5,151
All land[4]	35,011	5,701	6,818	7,248	7,866	7,378

[1] Land in Federal, State, or County reserves where cutting of timber is prohibited by law or regulation.
[2] Poor swamp and other more or less wooded land judged incapable of producing merchantable pulpwood within 100 years.
[3] Includes 209,000 acres of water according to survey standard of area classification, but defined by the Bureau of Census as land.
[4] From U.S. Bureau of Census, Land and Water Area of the United States, 1950.

TABLE 2.—Area of commercial forest land by ownership class and Forest Survey district, Wisconsin, 1956

(Thousand acres)

Ownership class	Total	Northeastern Wisconsin	Northwestern Wisconsin	Central Wisconsin	Southeastern Wisconsin	Southwestern Wisconsin
Federally owned or managed:						
National forest	[1]1,372	605	767	0	0	0
Indian	423	277	140	4	2	*
Bureau of land Management, Other	115	2	2	79	3	29
Total federal	1,910	884	909	83	5	29
State	541	211	185	94	35	16
County and municipal	2,615	758	1,429	380	18	30
Forest industry	933	478	343	90	13	9
Farmer-owned	6,372	878	1,141	1,671	720	1,962
Miscellaneous private	3,025	948	1,190	557	150	180
All ownerships	15,396	4,157	5,197	2,875	941	2,226

[1] Includes both operable (478,000 acres, and inoperable (894,000 acres) areas.
* Less than 500 acres.

TABLE 3.—Area of commercial forest land by forest type and Forest Survey district, Wisconsin, 1956

(Thousand acres)

Forest type	Total	Northeastern Wisconsin	Northwestern Wisconsin	Central Wisconsin	Southeastern Wisconsin	Southwestern Wisconsin
Softwoods:						
White pine	174	61	36	47	10	20
Red pine	148	61	39	27	10	11
Jack pine	692	123	248	292	1	28
Spruce-fir	373	215	145	5	6	2
Black spruce	260	142	108	9	0	1
Tamarack	185	61	64	38	15	7
Cedar	223	118	49	21	33	2
Total	2,055	781	689	439	75	71
Hardwoods:						
Northern hardwoods	2,663	920	1,037	225	173	308
Oak	2,573	127	265	888	216	1,075
Lowland hardwoods	941	191	260	201	148	143
Aspen-birch	4,611	1,540	2,112	618	89	252
Total	10,788	2,778	3,674	1,932	626	1,778
Nonstocked	2,553	598	834	504	240	377
All types	15,396	4,157	5,197	2,875	941	2,226

TABLE 4.—Area of commercial forest land by forest type and major ownership class, Wisconsin, 1956

(Thousand acres)

Type	All ownerships	Public ownerships	Private ownerships
White-red-jack pine:			
White Pine	174	63	111
Red pine	148	79	69
Jack pine	692	301	391
Total	1,014	443	571
Other conifers:			
Spruce-fir	373	192	181
Black spruce	260	138	122
Tamarack	185	65	120
Cedar	223	79	144
Total	1,041	474	567
Northern hardwoods	2,663	908	1,755
Oak	2,573	296	2,277
Lowland hardwoods	941	204	737
Aspen-birch	4,611	2,051	2,560
Nonstocked	2,553	690	1,863
All types	15,396	5,066	10,330

TABLE 6.—Area of commercial forest land by forest type and stand-size class, Wisconsin, 1956

(Thousand acres)

Forest type	All stands	Saw-timber stands	Pole-timber stands	Seedling and sapling stands	Non-stocked
Softwoods:					
White pine	174	117	28	29	
Red pine	148	39	14	95	
Jack pine	692	16	187	489	
Spruce-fir	373	2	102	269	
Black spruce	260	0	34	226	
Tamarack	185	1	43	141	
Cedar	223	17	103	103	
Total	2,055	192	511	1,352	
Hardwoods:					
Northern hardwoods	2,663	821	894	948	
Oak	2,573	855	933	785	
Lowland hardwoods	941	246	462	233	
Aspen-birch	4,611	19	2,123	2,469	
Total	10,788	1,941	4,412	4,435	
Nonstocked	2,553	—	—	—	2,553
All types	15,396	2,133	4,923	5,787	2,553

TABLE 5.—Area of commercial forest land by stand-size and ownership class, Wisconsin, 1956

(Thousand acres)

Stand-size class	All ownerships	National forest	Other public	Farmer	Private	
					Large (over 5,000 acres)	Small (less than 5,000 acres)
Sawtimber	2,133	150	266	1,368	87	262
Poletimber	4,923	483	1,080	2,082	331	947
Seedling & sapling	5,787	610	1,787	1,760	483	1,147
Nonstocked	2,553	129	561	1,162	185	516
All classes	15,396	1,372	3,694	6,372	1,086	2,872

TABLE 7.—Area of commercial forest land by stocking class of growing stock trees and by stand-size class, Wisconsin, 1956

(Thousand acres)

Stocking class	All stands	Saw-timber stands	Pole-timber stands	Seedling and sapling stands	Non-stocked stands
70 percent or more	3,697	273	686	2,738	
40 to 70 percent	5,002	817	1,980	2,205	
10 to 40 percent	4,144	1,043	2,257	844	
Less than 10 percent	2,553	—	—	—	2,553
All classes	15,396	2,133	4,923	5,787	2,553

TABLE 10.—Net volume of growing stock, sawtimber, and poletimber on commercial forest land by species, Wisconsin, 1956

Species	Growing stock	Sawtimber	Poletimber
	Thousand cords	Million bd. ft.	Thousand cords
Softwoods:			
White pine	3,894	1,369	606
Red pine	1,490	472	356
Jack pine	2,695	274	1,984
Spruce	999	117	701
Balsam fir	1,891	111	1,609
Tamarack	666	52	534
Cedar	2,447	313	1,633
Hemlock	3,567	1,217	525
Redcedar	9	*	8
Total	17,658	3,925	7,956
Hardwoods:			
Sugar maple	8,273	1,922	3,717
Yellow birch	2,537	619	1,063
Basswood	4,613	878	2,506
Beech	433	111	164
Elm	6,954	1,771	2,703
Red oaks	11,667	2,780	4,940
Black oak	3,606	598	2,159
White oaks	5,818	1,206	2,875
Aspen	20,624	813	18,673
Paper birch	4,353	188	3,889
Soft maple	4,464	615	3,007
Ash	4,230	508	3,001
Hickory	974	102	727
Cherry	632	50	511
Black walnut	127	31	52
Other hardwoods	901	162	510
Total	80,206	12,354	50,497
All species	97,864	16,279	58,453

* Less than ½-million board feet.

TABLE 8.—Area of commercial forest land by stand-size class and Forest Survey district, Wisconsin, 1956

Stand-size class	State total		Northeastern Wisconsin	Northwestern Wisconsin	Central Wisconsin	Southeastern Wisconsin	Southwestern Wisconsin
	Thousand acres	Percent	Thousand acres	Thousand acres	Thousand acres	Thousand acres	Thousand acres
Large sawtimber	779	5.0	172	46	75	135	351
Small sawtimber	1,355	8.8	244	250	291	181	389
Poletimber	4,923	32.0	1,344	1,849	792	247	691
Seedlings & saplings:							
Medium & well-stocked	4,942	32.1	1,636	1,907	1,013	100	286
Poorly stocked	844	5.5	163	311	200	38	132
Nonstocked	2,553	16.6	598	834	504	240	377
All stands	15,396	100.0	4,157	5,197	2,875	941	2,226

TABLE 9.—Number of growing stock and cull trees on commercial forest land by diameter class, and major species group, Wisconsin, 1956

(Thousand trees)

DBH class (inches)	Growing stock			Cull trees		
	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
3.0- 4.9	1,930,700	421,400	1,509,300	—	—	—
5.0- 6.9	760,300	157,900	602,400	49,200	3,700	45,500
7.0- 8.9	327,200	60,700	266,500	24,500	1,700	22,800
9.0-10.9	146,500	22,400	124,100	14,100	1,800	12,300
11.0-12.9	68,200	10,400	57,800	12,900	1,000	11,900
13.0-14.9	34,900	4,800	30,100	7,800	400	7,400
15.0-16.9	17,500	2,600	14,900	4,900	300	4,600
17.0-18.9	8,200	1,400	6,800	2,900	100	2,800
19.0-20.9	4,200	700	3,500	1,900	100	1,800
21.0-28.9	4,200	800	3,400	3,000	100	2,900
29+	200	*	200	400	*	400
Total	3,302,100	683,100	2,619,000	121,600	9,200	112,400

* Less than 50,000 trees.

TABLE 11.—Net volume of growing stock and sawtimber by species and Forest Survey district, Wisconsin, 1936 and 1956

Species group	Total volume		Northeastern Wisconsin		Northwestern Wisconsin		Southern Wisconsin[1]	
	1936	1956	1936	1956	1936	1956	1936	1956
				Thousand cords				
Growing stock:								
Pine	7,033	8,079	2,785	3,340	2,047	2,387	2,201	2,352
Hemlock	8,887	3,567	4,568	2,425	3,573	897	746	245
Other softwoods	6,564	6,012	2,619	3,148	2,829	2,029	1,116	835
Northern hardwoods[2]	22,843	15,856	9,343	6,137	6,145	4,874	7,355	4,845
Aspen	8,640	20,624	2,359	7,648	3,776	9,193	2,505	3,783
Other hardwoods	33,249	43,726	4,455	7,459	3,757	7,743	25,037	28,524
All species	87,216	97,864	26,129	30,157	22,127	27,123	38,960	40,584
				Million board feet				
Sawtimber:								
Pine	1,545	2,115	746	999	355	547	444	569
Hemlock	2,547	1,217	1,340	855	1,014	294	193	68
Other softwoods	963	593	270	301	478	203	215	89
Northern hardwoods[2]	4,794	3,530	2,133	1,472	1,170	853	1,491	1,205
Aspen	301	813	72	287	93	306	136	220
Other hardwoods	5,014	8,011	652	1,083	456	789	3,906	6,139
All species	15,164	16,279	5,213	4,997	3,566	2,992	6,385	8,290

[1] Includes southeastern, southwestern, and central survey districts.
[2] Sugar maple, yellow birch, beech, and basswood.

TABLE 12.—Net volume of growing stock on commercial forest land by species and diameter class, Wisconsin, 1956
(Thousand cubic feet)

Species	Total	Diameter class (inches)												
		5.0—6.9	7.0—8.9	9.0—10.9	11.0—12.9	13.0—14.9	15.0—16.9	17.0—18.9	19.0—20.9	21.0—22.9	23.0—24.9	25.0—26.9	27.0—28.9	29.0+
oftwoods:														
Eastern white &. red pine	430,720	27,600	49,360	41,600	58,240	60,880	54,240	41,760	30,960	21,600	14,960	8,240	6,960	14,320
Jack pine	215,600	84,640	74,080	27,520	20,400	6,480	1,920	560	0	0	0	0	0	0
Spruce & balsam fir	231,120	111,920	72,880	22,880	12,480	4,880	3,360	1,440	1,200	80	0	0	0	0
Eastern hemlock	285,360	14,640	27,280	26,080	39,280	42,400	35,120	29,440	20,320	15,760	13,840	10,000	7,760	3,440
Other eastern softwoods	249,760	92,320	81,680	29,440	21,040	10,880	5,600	2,960	1,920	1,840	320	1,360	320	80
Total	1,412,560	331,120	305,280	147,520	151,440	125,520	100,240	76,160	54,400	39,280	29,120	19,600	15,040	17,840
ardwoods:														
Sugar maple	661,840	87,280	103,200	106,960	82,720	84,960	58,800	46,400	34,400	22,480	15,760	10,800	2,880	5,200
Yellow birch	202,960	22,240	30,400	32,400	26,480	23,920	19,760	14,480	10,400	8,240	6,240	5,360	1,760	1,280
Basswood	369,040	60,640	69,840	70,000	47,520	42,320	29,440	17,520	10,400	7,120	5,280	2,880	3,840	2,240
Beech	34,640	2,080	3,920	7,120	5,680	4,800	5,920	1,760	1,760	400	320	320	560	0
Red oak	933,360	99,520	133,520	162,080	138,000	129,680	96,240	64,880	45,120	32,880	17,680	9,120	2,480	2,160
Black oak	288,480	58,880	63,120	50,800	39,360	29,520	20,320	11,520	8,800	3,760	1,280	1,120	0	0
White oak	465,440	51,280	81,600	97,120	73,840	64,800	40,000	24,320	14,000	7,520	4,560	1,840	1,280	3,280
Aspen	1,649,920	643,440	548,560	301,840	105,520	34,640	13,280	1,920	720	0	0	0	0	0
Soft maple	357,120	87,760	84,240	68,640	41,760	27,280	17,120	10,640	8,000	4,880	1,520	2,320	1,040	1,920
Ash	338,400	77,040	89,440	73,600	41,200	27,920	15,920	8,480	3,360	480	400	160	0	400
Hickory	77,920	17,120	20,880	20,160	9,040	6,080	3,120	640	880	0	0	0	0	0
Black walnut	10,240	960	1,360	1,840	1,920	2,480	800	560	0	320	0	0	0	0
Other eastern hardwoods	1,027,200	219,360	210,480	179,120	116,000	95,760	70,000	51,280	29,520	24,880	14,080	7,040	4,960	4,720
Total	6,416,560	1,427,600	1,440,560	1,171,680	729,040	574,160	390,720	254,400	167,360	112,960	67,120	40,960	18,800	21,200
ll species	7,829,120	1,758,720	1,745,840	1,319,200	880,480	699,680	490,960	330,560	221,760	152,240	96,240	60,560	33,840	39,040

TABLE 13.—Net volume of live sawtimber on commercial forest land by species and Forest Survey district, Wisconsin, 1956
(Million board feet)

Species	Total	Northeastern Wisconsin	Northwestern Wisconsin	Central Wisconsin	Southeastern Wisconsin	Southwestern Wisconsin
Softwoods:						
White pine	1,369	671	316	195	55	132
Red pine	472	238	156	56	7	15
Jack pine	274	90	75	97	0	12
Spruce	117	61	51	2	2	1
Balsam fir	111	53	53	2	2	1
Tamarack	52	5	13	17	15	2
Cedar	313	182	86	7	38	0
Hemlock	1,217	855	294	56	12	0
Redcedar	*	0	0	0	0	0
Total	3,925	2,155	1,044	432	131	163
Hardwoods:						
Sugar maple	1,922	849	417	267	1,364	254
Yellow birch	619	311	266	32	5	5
Basswood	878	236	170	116	64	292
Beech	111	76	0	*	35	0
Elm	1,771	461	259	318	323	410
Red oaks	2,780	178	143	593	314	1,552
Black oak	598	33	19	223	59	264
White oaks	1,206	28	29	290	246	613
Aspen	813	287	306	68	25	127
Paper birch	188	74	35	12	26	41
Soft maple	615	149	147	144	56	119
Ash	508	107	142	82	90	87
Hickory	102	6	2	3	45	46
Cherry	50	6	4	9	16	15
Black walnut	31	*	0	*	5	26
Other hardwoods	162	41	9	24	32	56
Total	12,354	2,842	1,948	2,181	1,477	3,906
All species	16,279	4,997	2,992	2,613	1,608	4,069

* Less than ½ million board feet.

TABLE 14.—Net volume of live sawtimber on commercial forest land by diameter class and species, Wisconsin, 1956
(Million board feet[1])

Species	Total	Diameter class (inches)						
		9.0—10.9	11.0—12.9	13.0—14.9	15.0—16.9	17.0—18.9	19.0—20.9	21.0 +
Softwoods:								
White pine	1,369	145	196	199	193	168	138	330
Red pine	472	71	107	118	89	49	24	14
Jack pine	274	133	98	31	9	3	*	*
Spruce	117	38	32	17	17	7	6	*
Balsam fir	111	75	29	7	0	0	0	0
Tamarack	52	23	18	6	3	*	2	0
Cedar	313	119	84	47	24	14	6	19
Hemlock	1,217	130	196	211	176	148	102	254
Redcedar	*	*	*	*	0	0	0	0
Total	3,925	734	760	636	511	389	278	617
Hardwoods:								
Sugar maple	1,922	—	436	448	310	245	182	301
Yellow birch	619	—	139	126	104	76	54	120
Basswood	878	—	248	220	154	91	54	111
Beech	111	—	29	25	30	9	9	9
Elm	1,771	—	428	400	288	234	145	276
Red oaks	2,780	—	713	670	497	335	233	332
Black oaks	598	—	204	152	104	60	46	32
White oaks	1,206	—	379	332	205	124	72	94
Aspen	813	—	550	180	69	10	4	0
Paper birch	188	—	92	45	33	14	1	3
Soft maple	615	—	220	144	91	56	42	62
Ash	508	—	213	145	82	44	17	7
Hickory	102	—	47	32	16	3	4	0
Cherry	50	—	30	11	6	3	0	0
Black walnut	31	—	10	13	4	3	0	1
Other hardwoods	162	—	50	40	37	16	7	12
Total	12,354	—	3,788	2,983	2,030	1,323	870	1,360
All species	16,279	734	4,548	3,619	2,541	1,712	1,148	1,977

[1] International ¼-inch rule.

* Less than 500,000 board feet.

TABLE 15.—Net volume of all timber on commercial forest land by class of timber and major species group, Wisconsin, 1956

(Thousand cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Sawtimber trees:			
Saw log portion	2,505,900	628,100	1,877,800
Upper stem portion	647,000	148,100	498,900
Total	3,152,900	776,200	2,376,700
Poletimber trees	4,676,200	636,400	4,039,800
All growing stock trees	7,829,100	1,412,600	6,416,500
Sound cull trees:			
Sawtimber-size trees	491,600	29,100	462,500
Poletimber-size trees	30,900	1,400	29,500
Total	522,500	30,500	492,000
Rotten cull trees:			
Sawtimber-size trees	856,300	49,100	807,200
Poletimber-size trees	53,800	2,300	51,500
Total	910,100	51,400	858,700
Salvable dead trees:			
Sawtimber-size trees	5,400	1,100	4,300
Poletimber-size trees	4,300	1,100	3,200
Total	9,700	2,200	7,500
Total, all timber	9,271,400	1,496,700	7,774,700

TABLE 17.—Net volume of growing stock and sawtimber on commercial forest land by ownership class and major species group, Wisconsin, 1956

Ownership class	All species	Softwoods	Hardwoods
GROWING STOCK Thousand cubic feet			
National forest	691,800	124,600	567,200
Other public	1,634,500	442,800	1,191,700
Farmer	3,275,000	420,600	2,854,400
Other private	2,227,800	424,600	1,803,200
All ownerships	7,829,100	1,412,600	6,416,500
SAWTIMBER Million board feet[1]			
National forest	1,131	303	828
Other public	3,419	1,406	2,013
Farmer	7,446	1,128	6,318
Other private	4,283	1,088	3,195
All ownerships	16,279	3,925	12,354

[1] International ¼-inch rule.

TABLE 16.—Net volume of growing stock, sawtimber, and poletimber on commercial forest land by ownership class and major species group, Wisconsin, 1956

Ownership class	All growing stock			Sawtimber			Poletimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousands cords	Thousand cords	Thousand cords	Million bd. ft.	Million bd. ft.	Million bd. ft.	Thousand cords	Thousand cords	Thousand cords
National forest	8,757	1,577	7,180	1,131	303	828	5,983	819	5,164
Indian	6,138	2,441	3,697	1,660	836	824	1,881	264	1,617
Other federal	1,259	312	947	192	61	131	785	160	625
State	2,820	656	2,164	393	128	265	1,853	336	1,517
County & municipal	10,472	2,196	8,276	1,174	381	793	7,636	1,251	6,385
Farmer	41,456	5,324	36,132	7,446	1,128	6,318	25,838	2,821	23,017
Other private	28,200	5,375	22,825	4,283	1,088	3,195	14,477	2,305	12,172
Total	99,102	17,881	81,221	16,279	3,925	12,354	58,453	7,956	50,497

TABLE 18.—Net volume of principal pulpwood species by Forest Survey district, Wisconsin, 1956

(Thousand cords)

Species	Total	Northeastern Wisconsin	Northwestern Wisconsin	Central Wisconsin	Southeastern Wisconsin	Southwestern Wisconsin
Softwoods:						
Jack pine	2,695	709	965	912	0	109
Spruce	999	590	366	24	14	5
Balsam fir	1,891	977	836	40	34	4
Hemlock	3,567	2,425	896	201	45	0
Total	9,152	4,701	3,063	1,177	93	118
Aspen	20,624	7,648	9,193	1,776	398	1,609
All pulp species	29,776	12,349	12,256	2,953	491	1,727

TABLE 19.—Net volume of growing stock and sawtimber on commercial forest land, by stand-size class and major species group, Wisconsin, 1956

Stand-size class	All species	Softwoods	Hardwoods
GROWING STOCK Thousand cubic feet			
Sawtimber	2,780,000	573,000	2,207,000
Poletimber	3,736,000	534,000	3,202,000
Seedling and sapling	1,159,000	277,000	882,000
Nonstocked	154,000	29,000	125,000
Total	7,829,000	1,413,000	6,418,000
SAWTIMBER Million board feet[1]			
Sawtimber	10,585	2,489	8,096
Poletimber	4,121	948	3,173
Seedling and sapling	1,196	435	761
Nonstocked	377	53	324
Total	16,279	3,925	12,354

[1] International ¼-inch rule.

TABLE 20.—Net volume of sawtimber on commercial forest land by species and quality class, Wisconsin, 1956 (Percent)

Species	Log grades [1]			
	No. 1	No. 2	No. 3	Tie & timber
Softwoods:				
White pine	36	33	31	—
Red pine	20	26	54	—
Hardwoods:				
Sugar maple	22	21	36	21
Basswood	19	23	36	22
American elm	24	30	27	19
Slippery elm	18	38	30	14
Red oaks	10	20	35	35
Black oak	7	11	12	70
White oaks	5	11	40	44
Ash	7	35	41	17

[1] For specifications see: Hardwoods—Hardwood Log Grades for Standard Lumber, U.S. Forest Prod. Lab. Rpt. D-1737, 60 pp., Madison, Wis., 1953; and Interim Specifications for Ties, Timbers, or Construction Material (unpublished), U. S. Forest Service, Wash., D.C., 1948. Softwoods—Official Grading Rules for Northern Hardwood and Softwood Logs, Northern Hemlock and Hardwood Mfrs. Assn., 12 pp., Oshkosh, Wis., 1943; (softwood log grades of Prime, No. 1, and No. 2 correspond to log grades No. 1, No. 2, and No. 3 above respectively).

TABLE 21.—Net volume of salvable dead sawtimber-size trees on commercial forest land by major species group, Wisconsin, 1956 (Million board feet[1])

Species group	Volume
Softwoods	7.1
Hardwoods	19.0
All species	26.1

[1] International ¼-inch rule.

TABLE 22.—Annual mortality of growing stock and sawtimber on commercial forest land by species, Wisconsin, 1956

Species	Growing stock	Sawtimber
	Thousand cu. ft.	Million bd. ft.[1]
Softwoods:		
Eastern white and red pine	8,170	26.7
Spruce and balsam fir	6,280	5.4
Other eastern softwoods	15,830	27.9
Total	30,280	60.0
Hardwoods:		
Hard maple	11,970	24.3
Yellow birch	3,310	8.0
White and red oaks	33,610	64.6
Hickory	560	.4
Ash, walnut, and black cherry	7,000	7.5
Other hardwoods	89,310	60.9
Total	145,760	165.7
All species	176,040	225.7

[1] International ¼-inch rule.

TABLE 23.—Annual mortality of growing stock and sawtimber on commercial forest land by cause of death and major species group, Wisconsin, 1956

Cause of death	Growing stock			Sawtimber		
	All Species	Softwood	Hardwood	All Species	Softwood	Hardwood
	Thousand cu. ft.	Thousand cu. ft.	Thousand cu. ft.	Million bd. ft.[1]	Million bd. ft.[1]	Million bd. ft.[1]
Fire	320	40	280	0.3	*	0.3
Insects	7,090	1,120	5,970	2.6	.7	1.9
Disease	53,800	3,690	50,110	61.2	9.5	51.7
Other	114,830	25,430	89,400	161.6	49.8	111.8
All causes	176,040	30,280	145,760	225.7	60.0	165.7

[1] International ¼-inch rule.

* Less than 500,000 board feet.

TABLE 24.—Net annual growth of growing stock, sawtimber and poletimber on commercial forest land by species, Wisconsin, 1956

Species	Growing stock	Sawtimber	Poletimber
	Thousand cords	Million bd. ft.	Thousand cords
Softwoods:			
White pine	94.4	42.2	-6.9
Red pine	53.9	17.8	11.1
Jack pine	151.8	27.6	80.0
Spruce	71.3	10.6	44.3
Balsam fir	129.6	17.4	85.2
Tamarack	35.5	4.3	24.4
White-cedar	48.3	13.9	12.2
Hemlock	32.0	17.1	-10.7
Redcedar	.2	0	.2
All softwoods	617.0	150.9	239.8
Hardwoods:			
Sugar maple	277.1	50.0	158.6
Yellow birch	45.2	11.5	17.8
Basswood	175.8	44.7	68.6
Beech	7.3	3.0	0
Elm	175.8	61.5	28.2
Red oaks	346.6	113.0	73.2
Black oak	99.5	25.2	38.5
White oaks	122.9	49.1	3.1
Aspen	1,206.1	169.7	798.8
Paper birch	177.0	16.9	135.2
Soft maple	215.8	30.6	143.3
Ash	146.1	26.6	81.9
Hickory	32.9	8.1	13.3
Cherry	48.4	6.1	33.5
Black walnut	4.3	2.0	-.5
Other hardwoods	45.4	9.1	23.5
All hardwoods	3,126.2	627.1	1,617.0
All species	3,743.2	778.0	1,856.8

TABLE 25.—Annual allowable cut of growing stock, sawtimber, and poletimber on commercial forest land by species, Wisconsin, 1956

Species	Growing stock	Sawtimber	Poletimber
	Thousand cords	Million bd. ft.	Thousand cords
Softwoods:			
White pine	96.4	35.7	10.7
Red pine	35.2	13.2	3.6
Jack pine	92.3	14.2	55.3
Spruce	21.3	3.1	13.3
Balsam fir	48.6	4.3	37.6
Tamarack	11.8	1.3	8.5
White-cedar	41.0	8.2	19.9
Hemlock	68.5	23.9	8.7
Total	415.1	103.9	157.6
Hardwoods:			
Sugar maple	160.5	46.6	50.1
Yellow birch	64.1	20.2	16.0
Basswood	80.0	19.7	32.8
Beech	8.9	2.5	2.8
Elm	113.6	32.9	34.6
Red oaks	232.3	63.7	78.2
Black oak	60.5	12.5	30.2
White oaks	110.1	25.5	47.9
Aspen	896.0	68.8	731.0
Paper birch	159.1	8.4	138.4
Soft maple	97.2	17.4	55.9
Ash	61.4	10.1	36.9
Other hardwoods	54.8	7.8	36.0
Total	2,098.5	336.1	1,290.8
All species	2,513.6	440.0	1,448.4

TABLE 26.—Annual allowable cut of growing stock and sawtimber on commercial forest land by species group and Forest Survey district, Wisconsin, 1956

Species group	Total	Northeastern Wisconsin	Northwestern Wisconsin	Central Wisconsin	Southeastern Wisconsin	Southwestern Wisconsin
			(Thousand cords)			
Growing stock:						
Softwoods	415.1	206.5	128.5	56.6	11.2	12.3
Northern hdwds.[1]	313.5	117.7	89.7	32.2	23.7	50.2
Aspen	896.0	356.4	379.9	86.7	13.0	60.0
Other hardwoods	889.0	174.3	152.1	111.5	109.8	341.3
Total	2,513.6	854.9	750.2	287.0	157.7	463.8
			(Million board feet)			
Sawtimber:						
Softwoods	103.9	55.1	30.1	12.7	2.0	4.0
Northern hdwds.[1]	89.0	36.7	22.1	9.6	5.6	15.0
Aspen	68.8	28.2	25.8	5.9	1.4	7.5
Other hardwoods	178.3	24.4	17.9	22.6	25.9	87.5
Total	440.0	144.4	95.9	50.8	34.9	114.0

[1] Sugar maple, yellow birch, beech, and basswood.

TABLE 27.—Annual allowable cut of principal pulpwood species by Forest Survey district, Wisconsin, 1956

(Thousand cords)

Species	Total	Northeastern Wisconsin	Northwestern Wisconsin	Central Wisconsin	Southeastern Wisconsin	Southwestern Wisconsin
Softwoods:						
Jack pine	92.3	30.6	28.7	29.4	-	3.6
Spruce	21.3	13.7	7.0	.5	.1	-
Balsam fir	48.6	24.8	22.3	1.0	.5	-
Hemlock	68.5	45.6	18.8	3.4	.7	-
Total	230.7	114.7	76.8	34.3	1.3	3.6
Aspen	896.0	356.4	379.9	86.7	13.0	60.0
All pulp species	1,126.7	471.1	456.7	121.0	14.3	63.6

TABLE 28.—Net annual growth and cut of growing stock on commercial forest land by species, Wisconsin, 1956
(Thousand cubic feet)

Species	Net annual growth	Annual allowable cut	Annual timber cut
Softwoods:			
Eastern white and red pine	11,864	10,528	6,698
Spruce and balsam fir	16,072	5,592	5,474
Other eastern softwoods	21,424	17,088	24,413
Total	49,360	33,208	36,585
Hardwoods:			
Sugar maple	22,168	12,840	19,505
Yellow birch	3,616	5,128	4,720
White and red oaks	45,520	27,392	31,102
Hickory	2,632	1,408	302
Ash, walnut, and black cherry	15,904	6,152	3,643
Other hardwoods	160,256	114,960	85,487
Total	250,096	167,880	144,759
All species	299,456	201,088	181,344

TABLE 29.—Net annual growth and cut of sawtimber on commercial forest land by species, Wisconsin, 1956
(Million board feet[1])

Species	Net annual growth	Annual allowable cut	Annual timber cut
Softwoods:			
Eastern white and red pine	60.0	48.9	33.7
Spruce and balsam fir	28.0	7.4	9.8
Other eastern softwoods	62.9	47.6	65.9
Total	150.9	103.9	109.4
Hardwoods:			
Sugar maple	50.0	46.6	58.9
Yellow birch	11.5	20.2	18.4
White and red oaks	187.3	89.2	92.8
Hickory	8.1	1.8	.5
Ash, walnut, and black cherry	34.7	11.6	8.2
Other hardwoods	335.5	166.7	115.8
Total	627.1	336.1	294.6
All species	778.0	440.0	404.0

[1] International ¼-inch rule.

TABLE 30.—Number of primary wood-using plants by Forest Survey district, Wisconsin, 1956

Kind of mill	Total	Northeastern Wisconsin	Northwestern Wisconsin	Central Wisconsin	Southeastern Wisconsin	Southwestern Wisconsin
Sawmills:	1,628	324	357	413	220	314
Large[1]	8	5	0	3	0	0
Medium[2]	55	13	17	7	5	13
Small[3]	1,565	306	340	403	215	301
Pulp plants	29	7	3	10	9	0
Veneer plants:	47	12	6	12	12	5
Standard grade	21	8	3	6	3	1
Container	26	4	3	6	9	4
Excelsior plants	4	1	0	1	1	1
Chemical plants	4	0	1	1	1	1
Cooperage plants	5	0	0	0	3	2
Miscellaneous plants[4]	36	5	8	8	7	8
Total	1,753	349	375	445	253	331

[1] Annual lumber production, 5 million board feet or more.
[2] Annual lumber production, 1 million to 4,999,000 board feet.
[3] Annual lumber production, less than 1 million board feet.
[4] Includes clothespin, woodenware, lath, and shingle plants, etc.

TABLE 31.—Volume of timber cut from growing stock by major species group, Wisconsin, 1936, and 1946 to 1956
(Thousand cords)

Year	All growing stock		
	All species	Softwoods	Hardwoods
1936	2,449	1,085	1,364
1946	2,339	615	1,724
1948	2,590	754	1,836
1950	1,936	674	1,262
1952	2,185	538	1,647
1954	1,964	454	1,510
1956	2,267	457	1,810

TABLE 32.—Actual cut of growing stock and sawtimber on commercial forest land by species group and Forest Survey district, Wisconsin, 1956

Species group	Total	Northeastern Wisconsin	Northwestern Wisconsin	Central Wisconsin	Southeastern Wisconsin	Southwestern Wisconsin
			(Thousand cords)			
Growing stock:						
Softwoods	457.3	190.9	138.9	113.9	4.2	9.4
Northern hdwds.[1]	374.7	168.1	86.1	44.7	52.0	23.8
Aspen	768.7	338.6	288.5	127.5	10.0	4.1
Other hardwoods	666.1	92.7	74.8	183.8	228.0	86.8
Total	2,266.8	790.3	588.3	469.9	294.2	124.1
			(Million bd. ft.)			
Sawtimber:						
Softwoods	109.4	50.4	34.2	20.6	2.6	1.6
Northern hdwds.[1]	99.9	47.0	19.4	10.8	6.4	16.3
Aspen	44.6	17.9	16.8	8.5	.3	1.1
Other hardwoods	150.1	18.1	11.2	36.9	20.7	63.2
Total	404.0	133.4	81.6	76.8	30.0	82.2

[1] Sugar maple, yellow birch, beech, and basswood.

TABLE 33.—Actual cut of principal pulpwood species, by Forest Survey district, Wisconsin, 1956
(Thousand cords)

Species	Total	Northeastern Wisconsin	Northwestern Wisconsin	Central Wisconsin	Southeastern Wisconsin	Southwestern Wisconsin
Softwoods:						
Jack pine	153.6	26.9	42.4	84.0	.3	0
Spruce	21.1	14.9	4.8	1.1	0	.3
Balsam fir	47.3	30.0	14.6	2.3	0	.4
Hemlock	119.6	62.1	47.2	9.1	*	1.2
Total	341.6	133.9	109.0	96.5	.3	1.9
Aspen	768.7	338.6	288.5	127.5	10.0	4.1
All pulp species	1,110.3	472.5	397.5	224.0	10.3	6.0

* Less than 50 cords.

TABLE 34.—Total output of timber products by products, type of material used, and major species group, Wisconsin, 1956

Product and species group	Total output in standard units		Output from roundwood		Output from plant by-products (standard units)
	Unit	Number	Standard units	Thousand cu. ft.	
Sawlogs:					
Softwoods	M bd. ft.[1]	72,382	72,382	11,903	—
Hardwoods	M bd. ft.[1]	251,159	251,159	43,083	—
Total	M bd. ft.[1]	323,541	323,541	54,986	—
Veneer logs & bolts:					
Softwoods	M bd. ft.	21	21	2	—
Hardwoods	M bd. ft.	30,382	30,382	4,673	—
Total	M bd. ft.	30,403	30,403	4,675	—
Cooperage logs & bolts:					
Softwoods	M bd. ft.	—	—	—	—
Hardwoods	M bd. ft.	2,597	2,597	400	—
Total	M bd. ft.	2,597	2,597	400	—
Pulpwood:					
Softwoods	Std. cords[2]	267,492	267,492	21,030	—
Hardwoods	Std. cords[2]	692,215	692,215	52,607	—
Total	Std. cords[2]	959,707	959,707	73,637	—
Piling:					
Softwoods	M lineal ft.	9	9	7	—
Hardwoods	M lineal ft.	91	91	69	—
Total	M lineal ft.	100	100	76	—
Poles:					
Softwoods	M pieces	25	25	180	—
Hardwoods	M pieces	—	—	—	—
Total	M pieces	25	25	180	—
Mine timbers (round):					
Softwoods	M cu. ft.	305	305	305	—
Hardwoods	M cu. ft.	65	65	65	—
Total	M cu. ft.	370	370	370	—
Miscellaneous industrial wood:[3]					
Softwoods	M cu. ft.	289	289	289	—
Hardwoods	M cu. ft.	8,225	6,487	6,487	1,738
Total	M cu. ft.	8,514	6,776	6,776	1,738
Posts (round and split):					
Softwoods	M pieces	4,354	4,354	3,561	—
Hardwoods	M pieces	5,832	5,832	4,925	—
Total	M pieces	10,186	10,186	8,486	—
Fuelwood:					
Softwoods	Std. cords	65,000	19,000	1,359	46,000
Hardwoods	Std. cords	1,277,000	1,115,000	79,191	162,000
Total	Std. cords	1,342,000	1,134,000	80,550	208,000
All products:					
Softwoods	M cu. ft.	XX	XX	38,636	3,244
Hardwoods	M cu. ft.	XX	XX	191,500	13,238
Total	M cu. ft.	XX	XX	230,136	16,482

[1] International ¼-inch rule.
[2] Rough wood basis (80 cubic feet of solid wood).
[3] Includes hewn ties, excelsior bolts, shingle bolts, turnery bolts, chemical wood, etc.

TABLE 35.—Total output of roundwood products, by source and major species group, Wisconsin, 1956
(Thousand cubic feet)

Source	All species	Softwoods	Hardwoods
Growing-stock trees:			
Sawtimber trees	78,820	19,787	59,033
Poletimber trees	86,345	14,245	72,100
Total	165,165	34,032	131,133
Cull trees	17,147	1,395	15,752
Salvable dead trees	20,253	1,645	18,608
Other sources	27,571	1,564	26,007
All sources	230,136	38,636	191,500

TABLE 36.—Percent change in timber cut between 1936 and 1956 by species or species group, Wisconsin

Species or species group	Timber cut 1936	Timber cut 1956	Change since 1936	
	Thousand cords	Thousand cords	Thousand cords	Percent
Softwoods:				
White and red pine	135	83	— 52	— 39
Jack pine	157	154	— 3	— 2
Spruce	47	21	— 26	— 55
Balsam	54	47	— 7	— 12
Hemlock	614	120	—494	— 80
Other softwoods	78	32	— 46	— 59
Total	1,085	457	—628	— 58
Hardwoods:				
Hard hardwoods	927	754	—173	— 19
Soft hardwoods	272	287	+ 15	+ 5
Aspen	165	769	+603	+364
Total	1,364	1,810	+446	+ 33
All species	2,449	2,267	—182	— 7

TABLE 38.—Annual timber cut from growing stock, sawtimber, and poletimber on commercial forest land by species, Wisconsin, 1956

Species	Total growing stock	Sawtimber	Poletimber
	Thousand cords	Million bd. ft.	Thousand cords
Softwoods:			
White pine	68	27.5	8
Red pine	15	6.2	2
Jack pine	154	19.9	100
Spruce	21	1.4	17
Balsam fir	47	8.4	24
Tamarack	6	.7	4
Cedar	26	3.3	15
Hemlock	120	42.0	16
Total	457	109.4	186
Hardwoods:			
Sugar maple	244	58.9	86
Yellow birch	59	18.4	16
Basswood	65	20.6	16
Beech	7	2.0	2
Elm	114	27.5	35
Red oak	300	75.5	80
White oak	89	17.3	35
Aspen	769	44.6	634
Balsam poplar	1	.2	*
Cottonwood	5	2.3	*
Paper birch	34	3.0	23
Soft maple	67	13.6	29
Ash	42	7.5	19
Hickory	4	.5	1
Cherry	1	.3	*
Walnut	1	.4	*
Other hardwoods	7	2.0	2
Total	1,809	294.6	978
All species	2,266	404.0	1,164

* Less than 500 cords.

TABLE 37.—Annual timber cut from growing stock by species and ownership class, Wisconsin, 1956
(Thousand cords)

Species	All ownerships	Public			Private
		Federal	State	County	
Softwoods:					
White and red pine	83	16	2	3	62
Jack pine	154	4	9	30	111
Hemlock	120	24	6	5	85
Other softwoods	100	12	2	17	69
Total	457	56	19	55	327
Hardwoods:					
Aspen	769	129	19	84	537
Other hardwoods	1,041	43	9	11	978
Total	1,810	172	28	95	1,515
All species	2,267	228	47	150	1,842

TABLE 39.—Annual timber cut from live sawtimber on commercial forest land by products and logging residues, and by major species group, Wisconsin, 1956
(Thousand board feet)

Products and residues	All species	Softwoods	Hardwoods
Roundwood products:			
Saw logs	234,121	61,835	172,286
Veneer logs and bolts	30,403	21	30,382
Cooperage logs and bolts	2,597	0	2,597
Pulpwood	77,299	41,750	35,549
Piling	450	39	411
Poles	604	604	0
Mine timbers	1,037	732	305
Miscellaneous industrial wood	10,401	1,008	9,393
Posts	3,193	872	2,321
Fuelwood	25,512	98	25,414
All products	385,617	106,959	278,658
Logging residues	18,363	2,473	15,890
Timber cut	403,980	109,432	294,548

TABLE 40.—Annual timber cut from growing stock on commercial forest lands by products and logging residues, and by major species group, Wisconsin, 1956
(Thousand cubic feet)

Products and residues	All species	Softwoods	Hardwoods
Roundwood products:			
Saw logs	54,108	11,764	42,344
Veneer logs and bolts	4,675	2	4,673
Cooperage logs and bolts	400	0	400
Pulpwood	71,760	20,106	51,654
Piling	76	7	69
Poles	180	180	0
Mine timbers	260	195	65
Miscellaneous industrial wood	5,911	283	5,628
Posts	3,844	1,352	2,492
Fuelwood	23,951	143	23,951
All products	165,165	34,032	131,133
Logging residues	16,179	2,553	13,626
Timber cut	181,344	36,585	144,759

TABLE 41.—Timber growth predictions, Wisconsin, 1956-1986[1]

Period	Assumed cut			Projected growth		
	All species	Softwoods	Hardwoods	All Species	Softwoods	Hardwoods
			GROWING STOCK Thousand cubic feet			
1956 (year of inventory)	181,300	36,600	144,700	299,440	49,360	250,080
1966 (plus 10 years)	180,400	41,800	138,600	320,640	51,360	269,280
1976 (plus 20 years)	230,000	53,800	176,200	389,120	53,920	335,200
1986 (plus 30 years)	272,800	65,900	206,900	401,120	49,520	351,600
			SAWTIMBER Million board feet[2]			
1956 (year of inventory)	404	109	294	778	151	627
1966 (plus 10 years)[3]	408	119	289	886	163	723
1976 (plus 20 years)	485	151	334	1,007	173	834
1986 (plus 30 years)	567	182	384	1,223	178	1,045

[1] The outlook for timber volumes and net annual growth in 1985 is based on assumptions that the annual timber products output in the United States and Wisconsin will rise with estimated increases in population and National income and that wood will maintain its relative position in the national economy; that forestry will continue to advance at the rate indicated by recent trends. The trends are predicated upon anticipated future timber product demands on Wisconsin's forests, continuing reforestation, a "thickening up" of natural stands, and other changes leading to a more productive forest resource.

[2] International ¼-inch rule.

[3] Predicted decline in use of fuelwood from sawtimber trees more than offset predicted increase in other sawtimber uses.

The Lake States Forest Experiment Station has also published reports on the forest resources of the following states:

THE TIMBER RESOURCE OF NORTH DAKOTA

by John R. Warner and Clarence D. Chase
Station Paper 36, 39 pp., illus. 1956

MINNESOTA'S FOREST RESOURCES

by R. N. Cunningham, A. G. Horn, and D. N. Quinney
U.S. Forest Serv., Resource Report 13, 52 pp., illus. 1958

MICHIGAN'S FOREST RESOURCES

by Virgil E. Findell, Ray E. Pfeifer, Arthur G. Horn, and Carl H. Tubbs
Station Paper 82, 46 pp., illus. 1960

U. S. Department of Agriculture—Tracy Lithographers, Inc., Roseville, Minnesota